

Phosphorus Ligands and Compounds

Many
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ETREM



Hotline/QQ: 400 666 7788

Phosphorus Ligands and Compounds



Strem Chemicals has been providing fine chemicals for research and commercial production for over fifty years. Throughout this time we have offered a wide range of phosphorus-based ligands. We have continued to expand our product line as new applications have been found for this class of compounds. Our current offerings include monodentate, multidentate, achiral and chiral ligands. Some of these items are only commercially available at Strem. We have also included our phosphorus kits at the back of this booklet for customers interested in screening experiments.

At Strem, we also offer a wide variety of catalysts, nanomaterials and CVD/ALD precursors. Most of our products are of high purity, typically at 99%, while some are as high as 99.9999% metals purity. As an effort to expand our product line, we continually seek to provide new technologies from around the globe. We have licensing agreements with industry and academia, which allow easier access to these patent-protected products for our customers. We look forward to continued growth in order to best serve our customers' needs with the quality and service they can trust from Strem.

As part of our ongoing commitment to quality, we have achieved ISO 9001 certification for the Quality Management System (QMS) at our corporate headquarters in Newburyport, Massachusetts.

In addition, custom synthesis services are provided on a contract basis. For pharmaceutical applications, manufacturing is conducted under current Good Manufacturing Practices (cGMP) in FDA inspected kilo-lab suites. Complete documentation is available, including validation and stability studies. Active Drug Master Files (DMF's) are maintained in North America and Europe.

Our other booklets, which focus on applications and product classes, are available in print per request and also on our website. Below is a list of current booklet titles that are available. Please also check our Product Resources section online to find additional literature offerings, such as the Strem Chemiker, our technical publication, and product literature sheets.

- Buchwald Ligands and Precatalysts
- Gold Elements & Compounds
- Heterogeneous Catalysts
- Kits
- Materials for Energy Applications
- Metal Catalysts for Organic Synthesis
- MOCVD, CVD & ALD Precursors
- Nanomaterials
- New Products
- Other Ligands
- Phosphorous Ligands and Compounds
- PURATREM: High Purity Inorganics

Ephraim S. Honig, Ph.D., M.B.A.
Chief Executive Officer



PHOS 08/17
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Glossary of Terms

[α]_D		Specific rotation
AAS		Atomic Absorption Standard
ACS		Conforms to American Chemical Society specifications
air sensitive	.....	Product may chemically react with atmospheric oxygen or carbon dioxide at ambient conditions. Handle and store under an inert atmosphere of nitrogen or argon.
amp	.....	Ampouled
b.p.	.....	Boiling point in °C at 760mm, unless otherwise noted
d.	.....	Density
dec.	.....	Decomposes
elec. gr.	.....	Electronic Grade, suitable for electronic applications
f.p.	.....	Flash point in °F
gran.	.....	Granular
heat sensitive	.....	Product may chemically degrade if stored for prolonged periods of time at ambient temperatures or higher. Store at 5°C or lower.
hydrate	.....	Unspecified water content which may vary slightly from lot to lot
hygroscopic	.....	Product may absorb water if exposed to the atmosphere for prolonged periods of time (dependent on humidity and temperature). Handle and store under an inert atmosphere of nitrogen or argon.
light sensitive	.....	Product may chemically degrade if exposed to light
liq.	.....	Liquid
m.p.	.....	Melting point in °C
moisture sensitive	.....	Product may chemically react with water. Handle and store under an inert atmosphere of nitrogen or argon.
NMR grade	.....	Suitable as a Nuclear Magnetic Resonance reference standard
optical grade	.....	For optical applications
pwdr.	.....	Powder
primary standard	.....	Used to prepare reference standards and standardize volumetric solutions
PURATREM	.....	Product has a minimum purity of 99.99% (metals basis)
purified	.....	A grade higher than technical, often used where there are no official standards
P. Vol.	.....	Pore volume
pyrophoric	.....	Product may spontaneously ignite if exposed to air at ambient conditions
reagent	.....	High purity material, generally used in the laboratory for detecting, measuring, examining or analyzing other substances
REO	.....	Rare Earth Oxides. Purity of a specific rare-earth metal expressed as a percentage of total rare-earths oxides.
SA	.....	Surface area
store cold	.....	Product should be stored at -18°C or 4°C, unless otherwise noted (see product details)
subl.	.....	Sublimes
superconductor grade	.....	A high purity, analyzed grade, suitable for preparing superconductors
tech. gr.	.....	Technical grade for general industrial use
TLC	.....	Suitable for Thin Layer Chromatography
v.p.	.....	Vapor pressure mm of Hg
xrl.	.....	Crystalline

About Purity

Chemical purity	.....	is reported after the chemical name, e.g. Ruthenium carbonyl, 99%
Metals purity	.....	is reported in parentheses with the respective element, e.g. Gallium (III) bromide, anhydrous, granular (99.999%-Ga) PURATREM where 100% minus the metal purity is equal to the maximum allowable percentage of trace metal impurity

Phosphorus Ligands and Compounds

INDEX OF REACTION TYPES

Sorted by Key Element

Amination

26-1150	(R)-(-)-1-[(S)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl]ethylidicyclohexylphosphine, min. 97%	47
26-0270	1,1'-Bis(diphenylphosphino)ferrocene, 99% DPPF	68
26-0960	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethylidicyclohexylphosphine, min. 97%	101
26-0965	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethylidicyclohexylphosphine, min. 97%	104
26-0650	(R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97%	117
26-0975	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidit-butylphosphine, min. 97%	171
26-1000	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino) ferrocenyl]ethylidicyclohexylphosphine, min. 97%	172
26-1001	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidicyclohexylphosphine, min. 97%	173
26-1230	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethyldiphenylphosphine, min. 97%	173
26-1101	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethyldiphenylphosphine, min. 97%	173
26-1170	(S)-(+)-1-[(R)-2-(Di-2-furylphosphino)ferrocenyl]ethylidic- 3,5-xylylphosphine, min. 97%	183
26-1175	(R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino) ferrocenyl]ethylidic-3,5-xylylphosphine, min. 97%	199
26-1156	(R)-(+)-[(R)-2-Diphenylphosphinoferrocenyl](N,N-dimethylamino) (2-diphenylphosphinophenyl)methane, min. 97%	213
26-1155	(S)-(-)-[(S)-2-Diphenylphosphinoferrocenyl] (N,N-dimethylamino) (2-diphenylphosphinophenyl)methane, min. 97% TANIAPHOS	214
26-1201	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidit-butylphosphine, min. 97%	216
26-1200	(R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethylidit-butylphosphine, min. 97%	215
26-1210	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidicyclohexylphosphine ethanol adduct, min. 97% (R)-(S)-JOSIPHOS	216
26-1211	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidicyclohexylphosphine ethanol adduct, min. 97% (S)-(R)-JOSIPHOS	218
26-1255	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidic-3,5-xylylphosphine, min. 97%	219
15-0066	(R)-(-)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(-)-DTBM-SEGPHOS®	26
15-0067	(S)-(+)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(+)-DTBM-SEGPHOS®	29
15-0044	(R)-(+)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	31
15-0433	racemic-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% rac-BINAP	59
15-0145	2,2'-Bis(diphenylphosphino)-1,1'- biphenyl, 98% BIPHEP	64
15-0415	4,5-Bis-(di-i-propylphosphinomethyl)acridine, 98+%	90
15-0478	(R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-DM-SEGPHOS®	105
15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP	108
15-0483	Butylid-1-adamantylphosphine, min. 95% [cataCXium® A]	125
15-1052	2-Di-t-butylphosphino-2',4',6'-tri-i-propyl-1,1'-biphenyl, min. 98% t-BuXPhos	153
15-1062	Dicyclohexyl(2,2-diphenyl-1-methylvinyl)phosphine Cy-vBRIDP	159
15-1145	2-(Dicyclohexylphosphino)-2'-(N,N-dimethylamino)-1,1'-biphenyl, 98% DavePhos	165
15-1146	2-Dicyclohexylphosphino-2',6'-di-i-propoxy-1,1'-biphenyl, min. 98% RuPhos	167
15-1148	2-Dicyclohexylphosphino-2'-methyl-1,1'-biphenyl, min. 98% MePhos	175

15-1084	11-Dicyclohexylphosphino-12-phenyl-9,10-ethenoanthracene dichloromethane adduct, min. 98% KITPHOS.....	177
15-1149	2-(Dicyclohexylphosphino)-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% XPhos	179
15-1242	9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS	186
15-1745	2-Diphenylphosphino-2'-(<i>N,N</i> -dimethylamino)-1,1'-biphenyl, 98% PhDavePhos.....	210
15-1765	2-[2-(Diphenylphosphino)ethyl]pyridine, min. 97%	212
15-2975	<i>N</i> -(2-Methoxyphenyl)-2-(<i>di</i> - <i>t</i> -butylphosphino)pyrrole, min. 95% [cataCXium® POMetB]	240
15-3550	<i>N</i> -Phenyl-2-(<i>di</i> - <i>t</i> -butylphosphino)indol, min. 98% [cataCXium® PlntB].....	247
15-3605	<i>N</i> -Phenyl-2-(dicyclohexylphosphino)indol, min. 95% [cataCXium® PlnCy]	249
15-3610	<i>N</i> -Phenyl-2-(dicyclohexylphosphino)pyrrole, 90% [cataCXium® PCy].....	249
15-5810	Tri- <i>t</i> -butylphosphine, 99%	271
15-5811	Tri- <i>t</i> -butylphosphine, 99% (10 wt% in hexanes)	272
15-5812	Tri- <i>t</i> -butylphosphine, 99% (10 wt% in hexanes) (Sure/Seal™ bottle)	272

Carbon-carbon bond formation-Cross coupling

26-0150	1,1'-Bis(<i>di</i> - <i>t</i> -butylphosphino)ferrocene, min. 98% DTBPF	20
26-1150	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl]ethyl-di-cyclohexylphosphine, min. 97%	47
26-0270	1,1'-Bis(diphenylphosphino)ferrocene, 99% DPPF	68
26-0960	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethyl-di-cyclohexylphosphine, min. 97%	101
26-0965	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%	104
26-0650	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di- <i>t</i> -butylphosphine, min. 97%.....	117
26-0975	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-di- <i>t</i> -butylphosphine, min. 97%	171
26-1000	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-(Dicyclohexylphosphino) ferrocenyl]ethyl-dicyclohexylphosphine, min. 97%....	172
26-1001	(<i>S</i>)-(+)-1-[(<i>R</i>)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-dicyclohexylphosphine, min. 97%....	173
26-1230	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-diphenylphosphine, min. 97%.....	173
26-1101	(<i>S</i>)-(+)-1-[(<i>R</i>)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-diphenylphosphine, min. 97%	173
26-1170	(<i>S</i>)-(+)-1-[(<i>R</i>)-2-(Di-2-furylphosphino)ferrocenyl]ethyl-di- 3,5-xylylphosphine, min. 97%	183
26-1175	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-(Di-1-naphthylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%.....	199
26-1201	(<i>S</i>)-(+)-1-[(<i>R</i>)-2-(Diphenylphosphino)ferrocenyl]ethyl-di- <i>t</i> -butylphosphine, min. 97%	216
26-1210	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-(Diphenylphosphino) ferrocenyl]ethyl-dicyclohexylphosphine ethanol adduct, min. 97% (<i>R</i>)-(<i>S</i>)-JOSIPHOS	216
26-1211	(<i>S</i>)-(+)-1-[(<i>R</i>)-2-(Diphenylphosphino)ferrocenyl]ethyl-dicyclohexylphosphine ethanol adduct, min. 97% (<i>S</i>)-(<i>R</i>)-JOSIPHOS	218
26-1255	(<i>R</i>)-(-)-1-[(<i>S</i>)-2-(Diphenylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%	219
26-3575	1,2,3,4,5-Pentaphenyl-1'-(<i>di</i> - <i>t</i> -butylphosphino)ferrocene, 95% CTC-Q-PHOS	246
15-1960	4-(Anthracen-9-yl)-3-(<i>t</i> -butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole, 98+% rac-AntPhos.....	1
15-1963	(<i>R</i>)-4-(Anthracen-9-yl)-3-(<i>t</i> -butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole,98+% (>99% ee) [(<i>R</i>)-AntPhos].....	2
15-1967	(<i>S</i>)-4-(Anthracen-9-yl)-3-(<i>t</i> -butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole,99+% (>99% ee) [(<i>S</i>)-AntPhos].....	2
15-1367	(11 <i>bS</i>)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>f</i>] [1,3,2]dioxaphosphepin, 98%, (99% ee).....	11
15-0150	(<i>R</i>)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (<i>R</i>)-(+)-BINAP	60
15-0151	(<i>S</i>)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (<i>S</i>)-(-)-BINAP	64

The Stream Product Line

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Carbon-carbon bond formation-Cross coupling

15-6362	1-(2,4,6-Trimethylphenyl)-2-(dicyclohexylphosphino)imidazole, min. 95% [cataCXium® PICy].....	282
15-7720	Tris(2,4-di-t-butylphenyl)phosphite, 98%.....	287

Carbon-carbon bond formation-General

26-1150	(R)-(-)-1-[(R)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl]ethyl-dicyclohexylphosphine, min. 97%	47
26-1130	(R)-(+)-1-[(R)-2-[2'-Bis(3,5-dimethyl-4-methoxyphenyl)phosphinophenyl]ferrocenyl]ethylbis(di-3,5-tri fluoromethylphenyl) phosphine, min. 97%	48
26-0290	1,1'-Bis(1-diphenylphosphino-1-methylethyl)ferrocene ethanol adduct, 97% HiersoPHOS-6 (Sylphos).....	72
26-0960	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethyl-dicyclohexylphosphine, min. 97%	101
26-0965	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%	104
26-0650	(R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97%.....	117
26-0956	(R)-(+)-1-[(R)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino) (2-dicyclohexylphosphinophenyl)methane, min. 97%	170
26-0955	(S)-(-)-[(S)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino) (2-dicyclohexylphosphinophenyl)methane, min. 97%	170
26-1000	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino) ferrocenyl]ethyl-dicyclohexylphosphine, min. 97%	172
26-1001	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-dicyclohexylphosphine, min. 97%	173
26-1230	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-diphenylphosphine, min. 97%.....	173
26-1101	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-diphenylphosphine, min. 97%.....	173
26-1120	(R)-(+)-1-[(R)-2-(2'-Dicyclohexylphosphinophenyl)ferrocenyl]ethylbis(3,5-trifluoromethylphenyl)phosphine, min. 97%.....	177
26-1170	(S)-(+)-1-[(R)-2-(Di-2-furylphosphino)ferrocenyl]ethyl-di- 3,5-xylylphosphine, min. 97%	183
26-1175	(R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%.....	199
26-1156	(R)-(+)-1-[(R)-2-Diphenylphosphinoferrocenyl](N,N-dimethylamino) (2-diphenylphosphinophenyl)methane, min. 97%	213
26-1155	(S)-(-)-[(S)-2-Diphenylphosphinoferrocenyl] (N,N-dimethylamino) (2-diphenylphosphino-phenyl)methane, min. 97% TANIAPHOS	214
26-1201	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethyl-di-t-butylphosphine, min. 97%	216
26-1200	(R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethyl-di-t-butylphosphine, min. 97%	215
26-1210	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethyl-dicyclohexylphosphine ethanol adduct, min. 97% (R)-(S)-JOSIPHOS	216
26-1211	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethyl-dicyclohexylphosphine ethanol adduct, min. 97% (S)-(R)-JOSIPHOS	218
26-1255	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%.....	219
26-1300	(R)-(-)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylbis(di-3,5-tri-fluoromethylphenyl)phosphine, min. 97%.....	225
26-1310	(R)-(-)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethyl-dicyclohexylphosphine, min. 97%	225
26-1315	(R)-(+)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethyl-diphenylphosphine, min. 97%	226
26-1320	(R)-(+)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethyl-di(3,5-xylyl)phosphine, min. 97%	227
26-1555	(R)-(+)-1-[(R)-2-(Di-3,5-xylylphosphinophenyl)ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%	235
26-3575	1,2,3,4,5-Pentaphenyl-1'-(di-t-butylphosphino)ferrocene, 95% CTC-Q-PHOS	246
15-0038	Benzyl-di-1-adamantylphosphine, min. 85% [cataCXium® ABn]	3
15-0052	(R)-(-)-1,1'-Binaphthyl-2,2'-diyl hydrogenphosphate, min. 98%	6
15-1366	(11bR)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	11

Carbon-carbon bond formation-General

15-1376	(11bR)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	11
15-1377	(11bS)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	11
15-0527	(11aR)-3,7-Bis[3,5-bis(trifluoromethyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%.....	12
15-0528	(11aS)-3,7-Bis[3,5-bis(trifluoromethyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%.....	12
15-0126	(R,R)-(-)-2,3-Bis(t-butylmethylphosphino)quinoxaline, min. 98% (R,R)-QuinoxP*.....	14
15-0127	(S,S)-(+)-2,3-Bis(t-butylmethylphosphino)quinoxaline, min. 98% (S,S)-QuinoxP*.....	15
15-0066	(R)-(-)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(-)-DTBM-SEGPBOS®.....	26
15-0067	(S)-(+)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(+)-DTBM-SEGPBOS®.....	29
15-0042	(R)-(-)-2,2'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	29
15-0043	(S)-(+)-2,2'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	31
15-0044	(R)-(+)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	31
15-0045	(S)-(-)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	32
15-0185	(R)-(+)-2,2'-Bis[di(3,5-dimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, 98% (R)-ECNU-Phos.....	32
15-0652	(R)-(-)-2,2'-Bis[di(3,5-di-i-propyl-4-dimethylaminophenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	35
15-0653	(S)-(+)-2,2'-Bis[di(3,5-di-i-propyl-4-dimethylaminophenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	35
15-0112	(R)-(+)-2,2'-Bis(di-2-furanylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	40
15-0113	(S)-(-)-2,2'-Bis(di-2-furanylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	40
15-1368	(11bR)-2,6-Bis(3,5-dimethylphenyl)-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	48
15-1369	(11bS)-2,6-Bis(3,5-dimethylphenyl)-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	48
15-1373	(11bR)-2,6-Bis(3,5-dimethylphenyl)-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	49
15-1374	(11bS)-2,6-Bis(3,5-dimethylphenyl)-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	49
15-0542	(11aR)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%.....	50
15-0543	(11aS)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%.....	51
15-0136	(R)-(+)-5,5'-Bis(diphenylphosphino)-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-SEGPBOS®.....	56
15-0137	(S)-(-)-5,5'-Bis(diphenylphosphino)-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(-)-SEGPBOS®.....	58
15-0140	(2R,3R)-(-)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (R,R)-NORPHOS.....	58
15-0141	(2S,3S)-(+)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (S,S)-NORPHOS.....	58
15-0433	racemic-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% rac-BINAP.....	59
15-0160	(2S,3S)-(-)-Bis(diphenylphosphino)butane (S,S)-CHIRAPHOS.....	65
15-0178	(R)-(+)-2,2'-Bis(diphenylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (R)-MeO-BIPHEP.....	67
15-0179	(S)-(-)-2,2'-Bis(diphenylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (S)-MeO-BIPHEP.....	68
15-2973	(S)-(-)-2,2'-Bis(diphenylphosphino)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl (S)-(-)-H ₈ -BINAP.....	75
15-0486	R-(-)-5,5'-Bis(diphenylphosphino)-2,2,2',2'-tetrafluoro-4,4'-bi-1,3-benzodioxole, dichloromethane adduct, min. 97% (R)-DIFLUORPHOS™.....	79
15-0490	R-(+)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 94% (R)-SYNPHOS™.....	80

Carbon-carbon bond formation-General

15-0491	S-(-)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 97% (S)-SYNPHOS™	82
15-0442	12,12'-Bis(diphenylphosphino)-9,9',10,10'-tetrahydro-11,11'-bi-9,10-ethenoanthracene, min. 98% CATPHOS	82
15-0654	(R)(+)-2,2'-Bis(di-i-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	86
15-0655	(S)(-)-2,2'-Bis(di-i-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	88
15-0156	(R)(+)-2,2'-Bis(di-p-tolylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	99
15-0157	(S)(-)-2,2'-Bis(di-p-tolylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	100
15-0158	(R)(+)-2,2'-Bis[di(3,4,5-trimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% ...	104
15-0159	(S)(-)-2,2'-Bis[di(3,4,5-trimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% ..	105
15-0478	(R)(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)(+)-DM-SEGPPOS®	105
15-0479	(S)(-)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)(-)-DM-SEGPPOS®	107
15-0488	(R)(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	108
15-0489	(S)(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	109
15-0522	(11bR)-N,N-Bis[(R)(-)-1-(2-methoxyphenyl)ethyl]dinaphtho[2,1-d:1',2'-f][1,3,2] dioxaphosphepin-4-amine, min. 98%	112
15-0523	(11bS)-N,N-Bis[(S)(+)-1-(2-methoxyphenyl)ethyl]dinaphtho[2,1-d:1',2'-f][1,3,2] dioxaphosphepin-4-amine, min. 98%	113
15-0518	N,N-Bis[(1R)(+)-phenylethyl]dibenzo[d,f][1,3,2]dioxaphosphepin-6-amine	114
15-0519	N,N-Bis[(1S)(-)-phenylethyl]dibenzo[d,f][1,3,2]dioxaphosphepin-6-amine	115
15-1395	(R)-3,3'-Bis2,4,6-triisopropylphenyl)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl-2,2'-diyl Hydrogenphosphate, 98%, (99% ee)	121
15-1394	(S)-3,3'-Bis2,4,6-triisopropylphenyl)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl-2,2'-diyl Hydrogenphosphate, 98%, (99% ee)	121
15-0340	(R)(-)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl-2,2'-diyl hydrogen phosphate, min. 98% [(R)-TIPSY]	121
15-0341	(S)(+)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl-2,2'-diyl hydrogen phosphate, min. 98% [(S)-TIPSY]	123
15-0483	Butyldi-1-adamantylphosphine, min. 95% [cataCXium® A]	125
15-1457	(11bR)(+)-4,4-Dibutyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% R-MARUOKA CAT P-NB	137
15-1458	(11bS)(-)-4,4-Dibutyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% S-Maruoka CAT P-NB	137
15-1464	(11bR)(+)-4,4-Di-t-butyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% R-MARUOKA CAT P-TB	138
15-1465	(11bS)(-)-4,4-Di-t-butyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% S-MARUOKA CAT P-TB	138
15-1725	Di-t-butyl(2-butenyl)phosphine (40% in xylene), 98% m-Crophos®	138
15-1729	Di-t-butyl(3-methyl-2-butenyl)phosphine (40% in xylene), 98% Crophos®	141
15-1049	2-Di-t-butylphosphino-2'-methyl)-1,1'-biphenyl, 99% t-BuMePhos	150
15-1055	(R)(+)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (R)-Cl-MeO-BIPHEP	156
15-1056	(S)(-)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (S)-Cl-MeO-BIPHEP	158
15-1147	2-Dicyclohexylphosphino-2',6'-bis(dimethylamino)-1,1'-biphenyl, min. 98% CPhos	161
15-6528	[2-Dicyclohexylphosphino-3-methoxy-N-methyl-N-phenylbenzenamine, 98% Zheda-Phos	174
15-1082	11-Dicyclohexylphosphino-12-(2-methoxyphenyl)-9,10-ethenoanthracene dichloromethane adduct, min. 98% o-MeO-KITPHOS	174
15-1084	11-Dicyclohexylphosphino-12-phenyl-9,10-ethenoanthracene dichloromethane adduct, min. 98% KITPHOS	177

15-1255	(S)-(+)-(2,6-Dimethyl-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 98%	192
15-1505	(3aR,8aR)-(-)-(2,2-Dimethyl-4,4,8,8-tetraphenyl-tetrahydro-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepin-6-yl)dimethylamine, min. 98%	195
15-7203	(2R)-1-(11bR)-(Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yl)-2-methyl-1,2,3,4-tetrahydroquinoline, 98%	196
15-7204	(2R)-1-(11bS)-(Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yl)-2-methyl-1,2,3,4-tetrahydroquinoline, 98%	197
15-1510	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)benzyl(methyl)amine, 99%	202
15-1521	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1S)-1-phenylethyl]amine, min. 95%	202
15-1520	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1R)-1-phenylethyl]amine, dichloromethane adduct, min. 95%	203
15-1227	(S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)-5H-dibenz[b,f]azepine, min. 97%	204
15-1232	(R)-(-)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (R)-MONOPHOS	206
15-1233	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (S)-MONOPHOS	207
15-1525	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)[(1R)-1-phenylethyl]amine, min. 95%	207
15-1765	2-[2-(Diphenylphosphino)ethyl]pyridine, min. 97%	212
15-1775	(R)-(+)-2-(Diphenylphosphino)-2'-methoxy-1,1'-binaphthyl, 99% (R)-MOP	220
15-1776	(S)-(-)-2-(Diphenylphosphino)-2'-methoxy-1,1'-binaphthyl, 99% (S)-MOP	221
15-1782	(R)-(+)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethoxy]phthalazine, min. 97% (R,R)-O-PINAP	223
15-1783	(S)-(-)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethoxy]phthalazine, min. 97% (R,S)-O-PINAP	223
15-1784	(R)-(+)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethyl]-1-phthalazinamine, min. 97% (R,R)-N-PINAP	223
15-1787	(R)-(+)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(S)-1-phenylethyl]-1-phthalazinamine, min. 97% (S,R)-N-PINAP	224
15-1786	(S)-(-)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethyl]-1-phthalazinamine, min. 97% (R,S)-N-PINAP	224
15-6525	[2,6-Di-i-propoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98% GorlosPhosHBF ₄	230
15-1392	(11bR)-4-Hydroxy-2,6-bis[4-(trifluoromethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 95%, (99% ee)	239
15-1393	(11bS)-4-Hydroxy-2,6-bis[4-(trifluoromethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 95%, (99% ee)	239
15-1381	(11bR)-4-Hydroxy-2,6-bis[2,4,6-tris(1-methylethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	239
15-1382	(11bS)-4-Hydroxy-2,6-bis[2,4,6-tris(1-methylethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	239
15-1388	(11bR)-4-Hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	239
15-1389	(11bS)-4-Hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	239
15-1390	(11bR)-4-Hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	239
15-1391	(11bS)-4-Hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	239
15-1386	(11bR)-4-Hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	240
15-1387	(11bS)-4-Hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	240

Carbon-carbon bond formation-General

15-3495	(S)-(+)-(8,9,10,11,12,13,14,15-Octahydro-3,5-dioxo-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, 99%	245
15-1383	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1384	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1378	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1379	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1396	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	246
15-1397	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	246
15-1370	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	246
15-1371	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphopin, 98%, (99% ee).....	246
15-5162	(11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (R)-SIPHOS-PE.....	254
15-5163	(11aS)-(-)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (S)-SIPHOS-PE.....	256
15-5156	(11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-phenoxy, min. 98% (R)-ShiP	257
15-5157	(11aS)-(-)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-phenoxy, min. 98% (S)-ShiP.....	258
15-1363	(11aR)-10,11,12,13-Tetrahydro-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%	259
15-1364	(11aS)-10,11,12,13-Tetrahydro-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%	260
15-1517	(3aR,8aR)-(-)-4,4,8,8-Tetrakis(3,5-diethylphenyl) tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphopin.....	260
15-1518	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-diethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphopin.....	261
15-1511	(3aR,8aR)-(-)-4,4,8,8-Tetrakis(3,5-dimethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphopin.....	261
15-1512	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-dimethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphopin.....	262
15-1513	(3aR,8aR)-(-)-4,4,8,8-Tetrakis(3,5-di-i-propylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphopin.....	263
15-1514	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-di-i-propylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphopin.....	264
15-5211	(S)-(-)-2,2',6,6'-Tetramethoxy-4,4'-bis(di(3,5-xylyl)phosphino)-3,3'-bipyridine, min. 95% CTH-(S)-Xylyl-P-Phos	265
15-5810	Tri-t-butylphosphine, 99%.....	271
15-5990	Tri-n-butylphosphonium tetrafluoroborate, 99%	273
15-6000	Tri-t-butylphosphonium tetrafluoroborate, 99%	274
15-6372	Tri-2-furylphosphine, 98+%	277
15-6520	[2,4,6-Trimethoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98% LB-PhosHBF ₄	280
15-7720	Tris(2,4-di-t-butylphenyl)phosphite, 98%.....	287

Carbon-carbon bond formation-Heck Reaction

15-0045	(S)-(-)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	32
15-0150	(R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP.....	60
15-0151	(S)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-BINAP	64

Carbon-carbon bond formation-Heck Reaction

15-0490	R-(+)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 94% (R)-SYNPHOS™	80
15-0491	S-(-)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 97% (S)-SYNPHOS™	82
15-0152	(R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-ToIBINAP	95
15-0153	(S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-ToIBINAP	97
15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP	108
15-0483	Butyldi-1-adamantylphosphine, min. 95% [cataCXium® A].....	125
15-1729	Di-t-butyl(3-methyl-2-butenyl)phosphine (40% in xylene), 98% Crophos®	141
15-1055	(R)-(+)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (R)-Cl-MeO-BIPHEP	156
15-1056	(S)-(-)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (S)-Cl-MeO-BIPHEP	158
15-1505	(3aR,8aR)-(-)-(2,2-Dimethyl-4,4,8,8-tetraphenyl-tetrahydro-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepin-6-yl)dimethylamine, min. 98%	195
15-1821	(R)-(+)-2-[2-(Diphenylphosphino)phenyl]-4-(1-methylethyl)-4,5-dihydrooxazole, 98% (R)-iPr-PHOX	227
15-1822	(S)-(-)-2-[2-(Diphenylphosphino)phenyl]-4-(1-methylethyl)-4,5-dihydrooxazole, 98% (S)-iPr-PHOX	228
15-5810	Tri-t-butylphosphine, 99%	271
15-5811	Tri-t-butylphosphine, 99% (10 wt% in hexanes)	272
15-5812	Tri-t-butylphosphine, 99% (10 wt% in hexanes) (Sure/Seal™ bottle)	272
15-6000	Tri-t-butylphosphonium tetrafluoroborate, 99%	274
15-7720	Tris(2,4-di-t-butylphenyl)phosphite, 98%	287

Carbon-heteroatom bond formation

26-0150	1,1'-Bis(di-t-butylphosphino)ferrocene, min. 98% DTBPF	20
26-0240	(S,S)-(+)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(dicyclohexylphosphino)ferrocene, min. 97%	42
26-0248	(S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis[di(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocene, min. 97%	43
26-0252	(S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(diphenylphosphino)ferrocene, min. 97%	45
26-0244	(S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis[di(3,5-trifluoromethylphenyl)phosphino]ferrocene, min. 97%	46
26-0270	1,1'-Bis(diphenylphosphino)ferrocene, 99% DPPF	68
26-0275	1,1'-Bis(di-i-propylphosphino)ferrocene, min. 98% DiPPF	89
26-0975	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-di-t-butylphosphine, min. 97%	171
26-1200	(R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethyl-di-t-butylphosphine, min. 97%	215
26-3575	1,2,3,4,5-Pentaphenyl-1'-(di-t-butylphosphino)ferrocene, 95% CTC-Q-PHOS	246
15-5186	(R)-(+)-7-[4(S)-(Benzyl)oxazol-2-yl]-7'-diphenylphosphino-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (Ra,S)-Ph-Bn-SiPHOX	5
15-1366	(11bR)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	11
15-1367	(11bS)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	11
15-1376	(11bR)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	11
15-1377	(11bS)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	11
15-0527	(11aR)-3,7-Bis[3,5-bis(trifluoromethyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%	12

15-0528	(11aS)-3,7-Bis[3,5-bis(trifluoromethyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%	12
15-0066	(R)-(-)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(-)-DTBM-SEGPPOS®	26
15-0067	(S)-(+)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(+)-DTBM-SEGPPOS®	29
15-0044	(R)-(+)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	31
15-4320	(+)-1,13-Bis[di(3,5-dimethylphenyl)phosphino]-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97% (R,R,R)-(+)-Xyl-SKP	33
15-4321	(-)-1,13-Bis[di(3,5-dimethylphenyl)phosphino]-(5aS,8aS,14aS)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97% (S,S,S)-(-)-Xyl-SKP	33
15-1368	(11bR)-2,6-Bis(3,5-dimethylphenyl)-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	48
15-1369	(11bS)-2,6-Bis(3,5-dimethylphenyl)-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	48
15-1373	(11bR)-2,6-Bis(3,5-dimethylphenyl)-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	49
15-1374	(11bS)-2,6-Bis(3,5-dimethylphenyl)-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)	49
15-4330	(+)-1,13-Bis[di(4-methylphenyl)phosphino]-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97% (R,R,R)-(+)-Tol-SKP	49
15-4331	(-)-1,13-Bis[di(4-methylphenyl)phosphino]-(5aS,8aS,14aS)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97% (S,S,S)-(-)-Tol-SKP	50
15-0542	(11aR)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%	50
15-0543	(11aS)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%	51
15-0140	(2R,3R)-(-)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (R,R)-NORPHOS...	58
15-0141	(2S,3S)-(+)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (S,S)-NORPHOS...	58
15-0433	racemic-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% rac-BINAP	59
15-0150	(R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP	60
15-0151	(S)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-BINAP	64
15-0145	2,2'-Bis(diphenylphosphino)-1,1'- biphenyl, 98% BIPHEP	64
15-4310	(+)-1,13-Bis(diphenyl)phosphino-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano [3,2-d]xanthene, 97% (R,R,R)-(+)-Ph-SKP	70
15-4311	(-)-1,13-Bis(diphenyl)phosphino-(5aS,8aS,14aS)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano [3,2-d]xanthene, 97% (S,S,S)-(-)-Ph-SKP	71
15-0380	Bis(2-diphenylphosphinophenyl)ether, 98% DPEphos	77
15-0486	R-(-)-5,5'-Bis(diphenylphosphino)-2,2,2',2'-tetrafluoro-4,4'-bi-1,3-benzodioxole, dichloromethane adduct, min. 97% (R)-DIFLUORPHOS™	79
15-0442	12,12'-Bis(diphenylphosphino)-9,9',10,10'-tetrahydro-11,11'-bi-9,10-ethenoanthracene, min. 98% CATPHOS	82
15-0415	4,5-Bis-(di-i-propylphosphinomethyl)acridine, 98+%	90
15-0152	(R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-TolBINAP	95
15-0153	(S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-TolBINAP	97
15-0478	(R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-DM-SEGPPOS®	105
15-0479	(S)-(-)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(-)-DM-SEGPPOS®	107
15-0476	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (R)-(+)-XylBINAP	107
15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP	108
15-0522	(11bR)-N,N-Bis[(R)-(-)-1-(2-methoxyphenyl)ethyl]dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-amine, min. 98%	112

15-0523	(11bS)-N,N-Bis[(S)-(+)-1-(2-methoxyphenyl)ethyl]dinaphtho[2,1-d:1',2'-f][1,3,2] dioxaphosphepin-4-amine, min. 98%	113
15-1395	(R)-3,3'-Bis(2,4,6-triisopropylphenyl)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl-2,2'-diyl Hydrogenphosphate, 98%, (99% ee)	121
15-1394	(S)-3,3'-Bis(2,4,6-triisopropylphenyl)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl-2,2'-diyl Hydrogenphosphate, 98%, (99% ee)	121
15-0340	(R)-(-)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl-2,2'-diyl hydrogen phosphate, min. 98% [(R)-TiPSY]	121
15-0341	(S)-(+)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl-2,2'-diyl hydrogen phosphate, min. 98% [(S)-TiPSY]	123
15-1090	2-(Di-1-adamantylphosphino) dimethylaminobenzene, 97% Me-DalPhos	131
15-1138	2-(Di-1-adamantylphosphino)-3,6-dimethoxy-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 95% AdBrettPhos	131
15-0961	(1S,2S)-(-)-1,2-Diaminocyclohexane-N,N'-bis(2'-diphenylphosphinobenzoyl), 95% (S,S)-DACH-Phenyl Trost Ligand	132
15-0960	(1R,2R)-(+)-1,2-Diaminocyclohexane-N,N'-bis(2'-diphenylphosphinobenzoyl), 98% (R,R)-DACH-Phenyl Trost Ligand	133
15-0963	(1R,2R)-(+)-1,2-Diaminocyclohexane-N,N'-bis(2'-diphenylphosphino-1-naphthoyl), min. 94% (R,R)-DACH-Naphthyl Trost Ligand	134
15-0964	(1S,2S)-(-)-1,2-Diaminocyclohexane-N,N'-bis(2'-diphenylphosphino-1-naphthoyl), min. 94% (S,S)-DACH-Naphthyl Trost Ligand	135
15-1157	2-Di[3,5-bis(trifluoromethyl)phenylphosphino]-3,6-dimethoxy-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% JackiePhos	136
15-1725	Di- <i>t</i> -butyl(2-butenyl)phosphine (40% in xylene), 98% m-Crophos®	138
15-1005	Di- <i>t</i> -butyl(2,2-diphenyl-1-methyl-1-cyclopropyl)phosphine cBRIDP	140
15-1065	Di- <i>t</i> -butyl(2,2-diphenyl-1-methylvinyl)phosphine, min. 98% vBRIDP	140
15-1017	Di- <i>t</i> -butylneopentylphosphine, min. 95% (DTBNpP)	142
15-1019	Di- <i>t</i> -butylneopentylphosphonium tetrafluoroborate, min. 95%	143
15-1043	racemic-2-Di- <i>t</i> -butylphosphino-1, 1'-binaphthyl, 98% TrixiePhos	144
15-1045	2-(Di- <i>t</i> -butylphosphino))-1,1'-biphenyl, 99% JohnPhos	145
15-1164	2-(Di- <i>t</i> -butylphosphino)-3,6-dimethoxy-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% t-BuBrettPhos	147
15-1048	2-Di- <i>t</i> -butylphosphino-2'-(N,N-dimethylamino))-1,1'-biphenyl, 98% tBuDavePhos	148
15-1168	2-(Di- <i>t</i> -butylphosphino)-3-methoxy-6-methyl-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% RockPhos	149
15-1063	2-Di- <i>t</i> -butylphosphino-4-methoxy-3,5,6-trimethyl-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% [~1:1 mixture with regioisomer, 2-Di- <i>t</i> -butylphosphino-5-methoxy-3,4,6-trimethyl-2',4',6'-tri- <i>i</i> -propylbiphenyl]	150
15-1049	2-Di- <i>t</i> -butylphosphino-2'-methyl)-1,1'-biphenyl, 99% t-BuMePhos	150
15-1051	2-Di- <i>t</i> -butylphosphino-3,4,5,6-tetramethyl-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% Me ₄ t-BuXPhos	152
15-1052	2-Di- <i>t</i> -butylphosphino-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% t-BuXPhos	153
15-1007	Dicyclohexyl(2,2-diphenyl-1-methylcyclopropyl)phosphine Cy-cBRIDP	159
15-1062	Dicyclohexyl(2,2-diphenyl-1-methylvinyl)phosphine Cy-vBRIDP	159
15-1140	2-(Dicyclohexylphosphino))-1,1'-biphenyl, 98% CyJohnPhos	160
15-1147	2-Dicyclohexylphosphino-2',6'-bis(dimethylamino)-1,1'-biphenyl, min. 98% CPhos	161
15-1152	2-(Dicyclohexylphosphino)-3,6-dimethoxy-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% BrettPhos	164
15-1145	2-(Dicyclohexylphosphino)-2'-(N,N-dimethylamino))-1,1'-biphenyl, 98% DavePhos	165
15-1154	2-Dicyclohexylphosphino-4'-(N,N-dimethylamino)-1,1'-biphenyl, 98%	167
15-1146	2-Dicyclohexylphosphino-2',6'-di- <i>i</i> -propoxy-1,1'-biphenyl, min. 98% RuPhos	167

15-1082	11-Dicyclohexylphosphino-12-(2-methoxyphenyl)-9,10-ethenoanthracene dichloromethane adduct, min. 98% o-MeO-KITPHOS.....	174
15-1148	2-Dicyclohexylphosphino-2'-methyl-)-1,1'-biphenyl, min. 98% MePhos.....	175
15-1084	11-Dicyclohexylphosphino-12-phenyl-9,10-ethenoanthracene dichloromethane adduct, min. 98% KITPHOS.....	177
15-1088	2-[2-(Dicyclohexylphosphino)phenyl]-1-methyl-1H-indole, min. 98% CM-Phos.....	178
15-1149	2-(Dicyclohexylphosphino)-2',4',6'-tri- <i>i</i> -propyl-1,1'-biphenyl, min. 98% XPhos	179
15-1248	[4-(<i>N,N</i> -Dimethylamino)phenyl]di- <i>t</i> -butylphosphine, min. 95% amphos.....	185
15-1242	9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS	186
15-1521	(<i>S</i>)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1- <i>a</i> ;3,4- <i>a'</i>]dinaphthalen-4-yl)bis[(1 <i>S</i>)-1-phenylethyl]amine, min. 95%	202
15-1520	(<i>S</i>)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1- <i>a</i> ;3,4- <i>a'</i>]dinaphthalen-4-yl)bis[(1 <i>R</i>)-1-phenylethyl]amine, dichloromethane adduct, min. 95%	203
15-1227	(<i>S</i>)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1- <i>a</i> ;3,4- <i>a'</i>]dinaphthalen-4-yl)-5H-dibenz[<i>b,f</i>]azepine, min. 97%	204
15-1745	2-Diphenylphosphino-2'-(<i>N,N</i> -dimethylamino)-1,1'-biphenyl, 98% PhDavePhos.....	210
15-1748	1-Diphenylphosphino-2-(<i>N,N</i> -dimethylamino)-1H-indene, 99% (contains vinylic isomer).....	211
15-1802	1-Di- <i>i</i> -propylphosphino-2-(<i>N,N</i> -dimethylamino)-1H-indene, 99%	231
15-5184	(11 <i>aR</i>)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1- <i>cd</i> :1',7'- <i>ef</i>]phosphocin, min. 97% (<i>R</i>)-SITCP	237
15-5185	(11 <i>aS</i>)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1- <i>cd</i> :1',7'- <i>ef</i>]phosphocin, min. 97% (<i>S</i>)-SITCP	238
15-1392	(11 <i>bR</i>)-4-Hydroxy-2,6-bis[4-(trifluoromethyl)phenyl]-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 95%, (99% ee).....	239
15-1393	(11 <i>bS</i>)-4-Hydroxy-2,6-bis[4-(trifluoromethyl)phenyl]-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 95%, (99% ee).....	239
15-1381	(11 <i>bR</i>)-4-Hydroxy-2,6-bis[2,4,6-tris(1-methylethyl)phenyl]-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	239
15-1382	(11 <i>bS</i>)-4-Hydroxy-2,6-bis[2,4,6-tris(1-methylethyl)phenyl]-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	239
15-1388	(11 <i>bR</i>)-4-Hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	239
15-1389	(11 <i>bS</i>)-4-Hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	239
15-1390	(11 <i>bR</i>)-4-Hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	239
15-1391	(11 <i>bS</i>)-4-Hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	239
15-1386	(11 <i>bR</i>)-4-Hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	240
15-1387	(11 <i>bS</i>)-4-Hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	240
15-2975	<i>N</i> -(2-Methoxyphenyl)-2-(di- <i>t</i> -butylphosphino)pyrrole, min. 95% [cataCXium® POMetB].....	240
15-1091	2-(2-Methoxyphenyl)-1-methyl-3-diphenylphosphino)-1H-indole, min. 98% PPh ₂ -Andole-Phos..	242
15-1383	(11 <i>bR</i>)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1384	(11 <i>bS</i>)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1378	(11 <i>bR</i>)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1379	(11 <i>bS</i>)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	245
15-1396	(11 <i>bR</i>)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1- <i>d</i> :1',2'- <i>fl</i>][1,3,2]dioxaphosphopin, 98%, (99% ee).....	246

Carbon-heteroatom bond formation

15-1397	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	246
15-1370	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	246
15-1371	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee).....	246
15-3550	N-Phenyl-2-(di-t-butylphosphino)indol, min. 98% [cataCXium® PlntB].....	247
15-3600	N-Phenyl-2-(di-t-butylphosphino)pyrrole, 95+% [cataCXium® PtB].....	248
15-3605	N-Phenyl-2-(dicyclohexylphosphino)indol, min. 95% [cataCXium® PlnCyl].....	249
15-5162	(11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (R)-SIPHOS-PE.....	254
15-5163	(11aS)-(-)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (S)-SIPHOS-PE.....	256
15-1363	(11aR)-10,11,12,13-Tetrahydro-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%.....	259
15-1364	(11aS)-10,11,12,13-Tetrahydro-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98%.....	260
15-1517	(3aR,8aR)-(-)-4,4,8,8-Tetrakis(3,5-diethylphenyl) tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin.....	260
15-1518	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-diethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin.....	261
15-1511	(3aR,8aR)-(-)-4,4,8,8-Tetrakis(3,5-dimethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin.....	261
15-1512	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-dimethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin.....	262
15-1513	(3aR,8aR)-(-)-4,4,8,8-Tetrakis(3,5-di-i-propylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin.....	263
15-1514	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-di-i-propylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin.....	264
15-5811	Tri-t-butylphosphine, 99% (10 wt% in hexanes).....	272
15-5812	Tri-t-butylphosphine, 99% (10 wt% in hexanes) (Sure/Seal™ bottle).....	272
15-6520	[2,4,6-Trimethoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98% LB-PhosHBF ₄	280
15-7720	Tris(2,4-di-t-butylphenyl)phosphite, 98%.....	287

Cyclization

26-1130	(R)-(+)-1-[(R)-2-[2'-Bis(3,5-dimethyl-4-methoxyphenyl)phosphinophenyl]ferrocenyl]ethylbis(di-3,5-tri fluoromethylphenyl) phosphine, min. 97%.....	48
26-0956	(R)-(+)-[(R)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino) (2-dicyclohexylphosphinophenyl)methane, min. 97%.....	170
26-0955	(S)-(-)-[(S)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino) (2-dicyclohexylphosphinophenyl)methane, min. 97%.....	170
26-1120	(R)-(+)-1-[(R)-2-(2'-Dicyclohexylphosphinophenyl)ferrocenyl]ethylbis(3,5-trifluoromethylphenyl)phosphine, min. 97%.....	177
26-1300	(R)-(-)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylbis(di-3,5-tri-fluoromethylphenyl)phosphine, min. 97%.....	225
26-1310	(R)-(-)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylidicyclohexylphosphine, min. 97%.....	225
26-1315	(R)-(+)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylidiphenylphosphine, min. 97%.....	226
26-1320	(R)-(+)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylid(3,5-xylyl)phosphine, min. 97%.....	227
26-1555	(R)-(+)-1-[(R)-2-(2'-Di-3,5-xylylphosphinophenyl)ferrocenyl]ethylid-3,5-xylylphosphine, min. 97%.....	235
15-5186	(R)-(+)-7-[4(S)-(Benzyl)oxazol-2-yl]-7'-diphenylphosphino-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (Ra,S)-Ph-Bn-SIPHOS.....	5
15-0066	(R)-(-)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(-)-DTBM-SEGPHOS®.....	26

Cyclization

15-0067	(S)-(+)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(+)-DTBM-SEGPPOS®	29
15-0044	(R)-(+)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	31
15-0045	(S)-(-)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	32
15-0136	(R)-(+)-5,5'-Bis(diphenylphosphino)-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-SEGPPOS® ..	56
15-0137	(S)-(-)-5,5'-Bis(diphenylphosphino)-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(-)-SEGPPOS® ...	58
15-0433	racemic-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% rac-BINAP	59
15-0490	R-(+)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 94% (R)-SYNPHOS™	80
15-0491	S-(-)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 97% (S)-SYNPHOS™	82
15-0478	(R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-DM-SEGPPOS®	105
15-0476	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (R)-(+)-XylBINAP	107
15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP	108
15-1055	(R)-(+)-5,5'-Dichloro-6,6'- dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (R)-Cl-MeO-BIPHEP	156
15-1056	(S)-(-)-5,5'-Dichloro-6,6'- dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (S)-Cl-MeO-BIPHEP	158
15-1505	(3aR,8aR)-(-)-(2,2-Dimethyl-4,4,8,8-tetraphenyl-tetrahydro-[1,3]dioxolo[4,5-e][1,3,2] dioxaphosphepin-6-yl)dimethylamine, min. 98%	195
15-1521	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1S)-1-phenylethyl]amine, min. 95%	202
15-1520	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1R)-1-phenylethyl]amine, dichloromethane adduct, min. 95%	203
15-1227	(S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)-5H-dibenz[b,f] azepine, min. 97%	204
15-5184	(11aR)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1-cd:1',7'-ef]phosphocin, min. 97% (R)-SITCP	237
15-5185	(11aS)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1-cd:1',7'-ef]phosphocin, min. 97% (S)-SITCP	238
15-5211	(S)-(-)-2,2',6,6'-Tetramethoxy-4,4'-bis(di(3,5-xylyl)phosphino)-3,3'-bipyridine, min. 95% CTH-(S)-Xylyl-P-Phos	265
15-6520	[2,4,6-Trimethoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98% LB-PhosHBF ₄	280

Cyclopropanation

15-4310	(+)-1,13-Bis(diphenyl)phosphino-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1] benzopyrano [3,2-d]xanthene, 97% (R,R,R)-(+)-Ph-SKP	70
15-4311	(-)-1,13-Bis(diphenyl)phosphino-(5aS,8aS,14aS)-5a,6,7,8,8a,9-hexahydro-5H-[1] benzopyrano [3,2-d]xanthene, 97% (S,S,S)-(-)-Ph-SKP	71

Decarboxylation

15-0066	(R)-(-)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(-)-DTBM-SEGPPOS®	26
15-0067	(S)-(+)-5,5'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(+)-DTBM-SEGPPOS®	29
15-0044	(R)-(+)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	31
15-0478	(R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-DM-SEGPPOS®	105

Hydroboration

26-1150	(R)-(-)-1-{(S)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl}ethyl-di-cyclohexylphosphine, min. 97%	47
26-0960	(R)-(-)-1-{(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl}ethyl-di-cyclohexylphosphine, min. 97%	101

Hydroboration

26-0965	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%	104
26-0650	(R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97%	117
26-1000	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino) ferrocenyl]ethylidicyclohexylphosphine, min. 97%	172
26-1001	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidicyclohexylphosphine, min. 97%	173
26-1230	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidiphenylphosphine, min. 97%	173
26-1101	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidiphenylphosphine, min. 97%	173
26-1170	(S)-(+)-1-[(R)-2-(Di-2-furylphosphino)ferrocenyl]ethyl-di- 3,5-xylylphosphine, min. 97%	183
26-1175	(R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%	199
26-1201	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethyl-di-t-butylphosphine, min. 97%	216
26-1210	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidicyclohexylphosphine ethanol adduct, min. 97% (R)-(S)-JOSIPHOS	216
26-1211	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidicyclohexylphosphine ethanol adduct, min. 97% (S)-(R)-JOSIPHOS	218
26-1255	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%	219
15-1960	4-(Anthracen-9-yl)-3-(t-butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole, 98+% rac-AntPhos	1
15-1963	(R)-4-(Anthracen-9-yl)-3-(t-butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole,98+% (>99% ee) [(R)-AntPhos]	2
15-1967	(S)-4-(Anthracen-9-yl)-3-(t-butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole,99+% (>99% ee) [(S)-AntPhos]	2
15-0150	(R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP	60
15-0151	(S)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-BINAP	64
15-0152	(R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-TolBINAP	95
15-0153	(S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-TolBINAP	97
15-0476	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (R)-(+)-XylBINAP	107
15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP	108

Hydroformylation

15-0176	(S)-(+)-1,13-Bis(diphenylphosphino)-7,8-dihydro-6H-dibenzo[f,h][1,5]dioxonin, 95% (S)-C ₃ -TUNEPHOS	66
15-0175	R-(-)-1,13-Bis(diphenylphosphino)-7,8-dihydro-6H-dibenzo[f,h][1,5]dioxonin, 97% (R)-C ₃ -TUNEPHOS	66
15-0437	4,6-Bis(diphenylphosphino) phenoxazine, min. 98% NIXANTPHOS	76
15-0476	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (R)-(+)-XylBINAP	107
15-0107	6,6'-[(3,3'-Di-t-butyl-5,5'-dimethoxy-1,1'-biphenyl-2,2'-diyl)bis(oxy)] bis(dibenzo[d,f][1,3,2]dioxaphosphepin) hemi ethyl acetate adduct, min. 95% BIPHEPHOS	139
15-1455	(+)-6,6'-[[[(1R,3R)-1,3-Dimethyl-1,3-propanediyl]bis(oxy)]bis[4,8-bis(t-butyl)-2,10-dimethoxy-bibenzo[d,f][1,3,2]dioxaphosphepin], min. 95% (R,R)-Chiraphite	194
15-1456	(-)-6,6'-[[[(1S,3S)-1,3-Dimethyl-1,3-propanediyl]bis(oxy)]bis[4,8-bis(t-butyl)-2,10-dimethoxy-bibenzo[d,f][1,3,2]dioxaphosphepin], min. 95% (S,S)-Chiraphite	194
15-1530	(S)-2-(1-Naphthyl)-8-diphenylphosphino-1-[(R)-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl]-1,2-dihydroquinoline toluene adduct, min. 97% (Ra,Sc)-(1-Nph)-Quinaphos	243

Hydrogenation

26-0201	(-)-1,1'-Bis[(2S,4S)-2,4-diethylphosphonato]ferrocene, min. 95% (S,S)-Et-FerroTANE®	39
26-0243	1,1'-Bis[(S)-4,5-dihydro-3H-binaphtho[1,2-c:2',1'-e]phosphino]ferrocene, min. 98% (S,S)-f-Binaphane	41
26-0240	(S,S)-(+)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(dicyclohexylphosphino) ferrocene, min. 97%	42

26-1150	(R)-(-)-1-[(S)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl]ethylidene-cyclohexylphosphine, min. 97%	47
26-1130	(R)-(+)-1-[(R)-2-[2'-Bis(3,5-dimethyl-4-methoxyphenyl)phosphinophenyl]ferrocenyl]ethylbis(di-3,5-trifluoromethylphenyl) phosphine, min. 97%	48
26-0275	1,1'-Bis(di-i-propylphosphino)ferrocene, min. 98% DiPPF	89
26-0960	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethylidene-cyclohexylphosphine, min. 97%	101
26-0965	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethylidene-3,5-xylylphosphine, min. 97%	104
26-1261	1,1'-Bis(1-[(R)-ferrocenyl-2-(S)-ethyl-1-(diethylamino) phenyl]-[R]-phosphino) ferrocene, min. 97% Trifer	111
26-1260	1,1'-Bis(1-[(S)-ferrocenyl-2-(R)-ethyl-1-(dimethylamino) phenyl]-[S]-phosphino) ferrocene, min. 97% Trifer	111
26-0650	(R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97%	117
26-1271	(S, R(p), S(SPO)-(1-t-Butylphosphinoyl)-2-[1-(diphenylphosphino)ethyl]ferrocene, min. 97% JoSPOphos	129
26-1270	(R, S(p), R(SPO)-(1-t-Butylphosphinoyl)-2-[1-(diphenylphosphino)ethyl]ferrocene, min. 97% JoSPOphos	129
26-0956	(R)-(+)-[(R)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino) (2-dicyclohexylphosphinophenyl)methane, min. 97%	170
26-0955	(S)-(-)-[(S)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino) (2-dicyclohexylphosphinophenyl)methane, min. 97%	170
26-1000	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino) ferrocenyl]ethylidene-cyclohexylphosphine, min. 97%	172
26-1001	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidene-cyclohexylphosphine, min. 97%	173
26-1230	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidene-diphenylphosphine, min. 97%	173
26-1101	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidene-diphenylphosphine, min. 97%	173
26-1120	(R)-(+)-1-[(R)-2-(2'-Dicyclohexylphosphinophenyl)ferrocenyl]ethylbis(3,5-trifluoromethylphenyl)phosphine, min. 97%	177
26-1170	(S)-(+)-1-[(R)-2-(Di-2-furylphosphino)ferrocenyl]ethylidene-3,5-xylylphosphine, min. 97%	183
26-1175	(R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino) ferrocenyl]ethylidene-3,5-xylylphosphine, min. 97%	199
26-1156	(R)-(+)-[(R)-2-Diphenylphosphinoferrocenyl](N,N-dimethylamino) (2-diphenylphosphinophenyl)methane, min. 97%	213
26-1155	(S)-(-)-[(S)-2-Diphenylphosphinoferrocenyl] (N,N-dimethylamino) (2-diphenylphosphinophenyl)methane, min. 97% TANIAPHOS	214
26-1201	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidene-t-butylphosphine, min. 97%	216
26-1200	(R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethylidene-t-butylphosphine, min. 97%	215
26-1210	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidene-cyclohexylphosphine ethanol adduct, min. 97% (R)-(S)-JOSIPHOS	216
26-1211	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidene-cyclohexylphosphine ethanol adduct, min. 97% (S)-(R)-JOSIPHOS	218
26-1255	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidene-3,5-xylylphosphine, min. 97%	219
26-2515	(R)-1-[(S)-2-Diphenylphosphinoferrocenyl](N-methyl)(N-diphenylphosphino)ethylamine (R)-Me-Bophoz	219
26-2516	(S)-1-[(R)-2-Diphenylphosphinoferrocenyl](N-methyl)(N-diphenylphosphino)ethylamine (S)-Me-Bophoz	220
26-1300	(R)-(-)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylbis(di-3,5-trifluoromethylphenyl) phosphine, min. 97%	225
26-1310	(R)-(-)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylidene-cyclohexylphosphine, min. 97% ..	225
26-1315	(R)-(+)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylidene-diphenylphosphine, min. 97% ..	226
26-1320	(R)-(+)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylidene(3,5-xylyl)phosphine, min. 97% ..	227
26-1555	(R)-(+)-1-[(R)-2-(2'-Di-3,5-xylylphosphinophenyl)ferrocenyl]ethylidene-3,5-xylylphosphine, min. 97% ..	235

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Hydrogenation

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15-0145	2,2'-Bis(diphenylphosphino)-1,1'- biphenyl, 98% BIPHEP	64
15-0176	(S)-(+)-1,13-Bis(diphenylphosphino)-7,8-dihydro-6H-dibenzo[f,h][1,5]dioxonin, 95% (S)-C ₃ -TUNEPHOS	66
15-0175	R-(-)-1,13-Bis(diphenylphosphino)-7,8-dihydro-6H-dibenzo[f,h][1,5]dioxonin, 97% (R)-C ₃ -TUNEPHOS	66
15-0178	(R)-(+)-2,2'-Bis(diphenylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (R)-MeO-BIPHEP	67
15-0179	(S)-(-)-2,2'-Bis(diphenylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (S)-MeO-BIPHEP	68
15-2972	(R)-(+)-2,2'-Bis(diphenylphosphino)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl (R)-(+)-H ₈ -BINAP	73
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15-0426	(S)-(+)-4,12-Bis(diphenylphosphino)-[2.2]-paracyclophane, min. 95% (S)-PHANEPHOS	76
15-0486	R-(-)-5,5'-Bis(diphenylphosphino)-2,2,2',2'-tetrafluoro-4,4'-bi-1,3-benzodioxole, dichloromethane adduct, min. 97% (R)-DIFLUORPHOS™	79
15-0487	S-(+)-5,5'-Bis(diphenylphosphino)-2,2,2',2'-tetrafluoro-4,4'-bi-1,3-benzodioxole, dichloromethane adduct, min. 97% (S)-DIFLUORPHOS™	80
15-0490	R-(+)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 94% (R)-SYNPHOS™	80
15-0491	S-(-)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 97% (S)-SYNPHOS™	82
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15-0654	(R)-(+)-2,2'-Bis(di-i-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	86
15-0655	(S)-(-)-2,2'-Bis(di-i-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	88
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15-0411	(-)-1,2-Bis((2S,5S)-2,5-di-i-propylphospholano)benzene, 98+% (S,S)-i-Pr-DUPHOS	94
15-0152	(R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-TolBINAP	95
15-0153	(S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-TolBINAP	97
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15-0478	(R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-DM-SEGPHOS®	105
15-0476	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (R)-(+)-XylBINAP	107
15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP	108
15-0488	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	108
15-0489	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%.....	109
15-0730	(R)-(-)-4,12-Bis(di(3,5-xylyl)phosphino)-[2.2]-paracyclophane, min. 97% CTH-(R)-3,5-xylyl-PHANEPHOS.....	110
15-0731	(S)-(+)-4,12-Bis(di(3,5-xylyl)phosphino)-[2.2]-paracyclophane, min. 97% CTH-(S)-3,5-xylyl-PHANEPHOS	111
15-0710	(R)-4,12-Bis(4-methoxyphenyl)-[2.2]-paracyclophane R-An-Phanephos	113
15-0711	(S)-4,12-Bis(4-methoxyphenyl)-[2.2]-paracyclophane S-An-Phanephos	113
15-1970	(2R,2'R,3R,3'R)-4,4'-Di(anthracen-9-yl)-3,3'-di-t-butyl-2,2',3,3'-tetrahydro-2,2'-bibenzo[d][1,3]oxaphosphole, min 98% (>90% ee), [(2R,2'R,3R,3'R)-WingPhos]	135

15-1975	(2S,2'S,3S,3'S)-4,4'-Di-(anthracen-9-yl)-3,3'-di-t-butyl-2,2',3,3'-tetrahydro-2,2'-bibenzo[d][1,3]oxaphosphole, min 98%, (>99% ee), [(2S,2'S,3S,3'S)-WingPhos]	136
15-1053	(3S,3'S,4S,4'S,11bS,11'bS)-(+)-4,4'-Di-t-butyl-4,4',5,5'-tetrahydro-3,3'-bi-3H-dinaphtho[2,1-c:1',2'-e]phosphepin, 97% (S)-BINAPINE	155
15-1060	(1R,1'R,2S,2'S)-(+)-2,2'-Di-t-butyl-2,3,2',3'-tetrahydro-1,1'-bi-1H-isophosphindole, min. 98% (R,R,S,S)-DUANPHOS	156
15-1055	(R)-(+)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (R)-Cl-MeO-BIPHEP	156
15-1056	(S)-(-)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (S)-Cl-MeO-BIPHEP	158
15-1255	(S)-(+)-(2,6-Dimethyl-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 98%	192
15-1510	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)benzyl(methyl)amine, 99%	202
15-1521	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1S)-1-phenylethyl]amine, min. 95%	202
15-1520	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1R)-1-phenylethyl]amine, dichloromethane adduct, min. 95%	203
15-1231	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)diethylamine, min. 97%	205
15-1232	(R)-(-)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (R)-MONOPHOS	206
15-1233	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (S)-MONOPHOS	207
15-1235	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)morpholine, min. 97% (S)-MorPhos	207
15-1525	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)((1R)-1-phenylethyl)amine, min. 95%	207
15-1234	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)piperidine, min. 97% (S)-PipPhos	208
15-1821	(R)-(+)-2-[2-(Diphenylphosphino)phenyl]-4-(1-methylethyl)-4,5-dihydrooxazole, 98% (R)-iPr-PHOX	227
15-1822	(S)-(-)-2-[2-(Diphenylphosphino)phenyl]-4-(1-methylethyl)-4,5-dihydrooxazole, 98% (S)-iPr-PHOX	228
15-1530	(S)-2-(1-Naphthyl)-8-diphenylphosphino-1-[(R)-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl]-1,2-dihydroquinoline toluene adduct, min. 97% (Ra,Sc)-(1-Nph)-Quinaphos	243
15-3495	(S)-(+)-(8,9,10,11,12,13,14,15-Octahydro-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, 99%	245
15-5162	(11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (R)-SIPHOS-PE	254
15-5163	(11aS)-(-)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (S)-SIPHOS-PE	256
15-5156	(11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-phenoxy, min. 98% (R)-ShiP	257
15-5157	(11aS)-(-)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-phenoxy, min. 98% (S)-ShiP	258
15-5130	(11aR)-(+)-10,11,12,13-Tetrahydro-5-(1,1-dimethylethyl)diindeno[7,1-de,1',7'-fg][1.3.2]dioxaphosphocin, 97% (R)-FuP-tBu	258
15-5131	(11aS)-(-)-10,11,12,13-Tetrahydro-5-(1,1-dimethylethyl)diindeno[7,1-de,1',7'-fg][1.3.2]dioxaphosphocin, 97% (S)-FuP-tBu	259
15-5201	(S)-(-)-2,2',6,6'-Tetramethoxy-4,4'-bis(diphenylphosphino)-3,3'-bipyridine, min. 95% CTH-(S)-P-Phos	264
15-5200	(R)-(+)-2,2',6,6'-Tetramethoxy-4,4'-bis(diphenylphosphino)-3,3'-bipyridine, min. 97% CTH-(R)-P-Phos	264
15-5211	(S)-(-)-2,2',6,6'-Tetramethoxy-4,4'-bis(di(3,5-xylyl)phosphino)-3,3'-bipyridine, min. 95% CTH-(S)-Xylyl-P-Phos	265
15-5210	(R)-(+)-2,2',6,6'-Tetramethoxy-4,4'-bis(di(3,5-xylyl)phosphino)-3,3'-bipyridine, min. 97% CTH-(R)-Xylyl-P-PHOS	267
15-7888	Tris[2-(diphenylphosphino)ethyl]phosphine, 98% PP ₃	289

Hydrosilylation

26-1150	(R)-(-)-1-[(S)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl]ethylidicyclohexylphosphine, min. 97%	47
26-0960	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethylidicyclohexylphosphine, min. 97%	101
26-0965	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethylidicyclohexylphosphine, min. 97%	104
26-0650	(R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97%.....	117
26-1000	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino) ferrocenyl]ethylidicyclohexylphosphine, min. 97%....	172
26-1001	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidicyclohexylphosphine, min. 97%....	173
26-1230	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidiphenylphosphine, min. 97%.....	173
26-1101	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidiphenylphosphine, min. 97%.....	173
26-1170	(S)-(+)-1-[(R)-2-(Di-2-furylphosphino)ferrocenyl]ethylidicyclohexylphosphine, min. 97%	183
26-1175	(R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino) ferrocenyl]ethylidicyclohexylphosphine, min. 97%.....	199
26-1201	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidicyclohexylphosphine, min. 97%	216
26-1210	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidicyclohexylphosphine ethanol adduct, min. 97% (R)-(S)-JOSIPHOS	216
26-1211	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidicyclohexylphosphine ethanol adduct, min. 97% (S)-(R)-JOSIPHOS	218
26-1255	(R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidicyclohexylphosphine, min. 97%	219
15-1775	(R)-(+)-2-(Diphenylphosphino)-2'-methoxy-1,1'-binaphthyl, 99% (R)-MOP.....	220
15-1776	(S)-(-)-2-(Diphenylphosphino)-2'-methoxy-1,1'-binaphthyl, 99% (S)-MOP	221
15-5210	(R)-(+)-2,2',6,6'-Tetramethoxy-4,4'-bis(di(3,5-xylyl)phosphino)-3,3'-bipyridine, min. 97% CTH-(R)-Xylyl-P-PHOS	267

Kinetic Resolution

15-0150	(R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP	60
15-0151	(S)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-BINAP	64
15-0490	R-(+)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 94% (R)-SYNPHOS™	80
15-0491	S-(-)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 97% (S)-SYNPHOS™	82
15-0152	(R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-TolBINAP	95
15-0153	(S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-TolBINAP	97
15-0476	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (R)-(+)-XylBINAP	107
15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP	108

Oxidation

15-0140	(2R,3R)-(-)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (R,R)-NORPHOS	58
15-0141	(2S,3S)-(+)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (S,S)-NORPHOS	58

Ring Opening

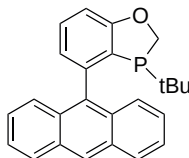
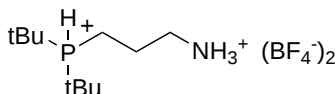
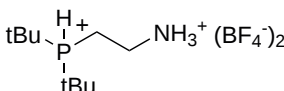
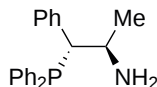
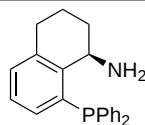
15-5186	(R)-(+)-7-[4(S)-(Benzyl)oxazol-2-yl]-7'-diphenylphosphino-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (Ra,S)-Ph-Bn-SIPHOS	5
15-5184	(11aR)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1-cd:1',7'-ef]phosphocin, min. 97% (R)-SITCP	237
15-5185	(11aS)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1-cd:1',7'-ef]phosphocin, min. 97% (S)-SITCP	238

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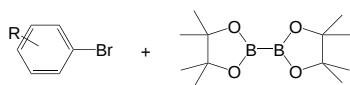
PHOSPHORUS - Ligands and Compounds

93-1501	Allyltriphenylphosphonium bromide, 99% (1560-54-9) (CH ₂ =CHCH ₂)(C ₆ H ₅) ₃ PBr; FW: 383.26; white xtl.; m.p. 222-225°	25g 100g
15-7143	(R)-1-Amino-8-(diphenylphosphino)-1,2,3,4-tetrahydronaphthalene, min. 97% (960128-64-7) C ₂₂ H ₂₂ NP; FW: 331.39; white solid <i>air sensitive</i>	250mg 1g
15-7144	(S)-1-Amino-8-(diphenylphosphino)-1,2,3,4-tetrahydronaphthalene, min. 97% (1222630-45-6) C ₂₂ H ₂₂ NP; FW: 331.39; white solid <i>air sensitive</i>	250mg 1g
15-7107	(1R,2R)-2-Amino-1-phenylpropyldiphenylphosphine, min. 97% (799297-44-2) C ₂₁ H ₂₂ NP; FW: 319.38; white solid <i>air sensitive</i>	100mg 500mg
15-7108	(1S,2S)-2-Amino-1-phenylpropyldiphenylphosphine, min. 97% (341968-71-6) C ₂₁ H ₂₂ NP; FW: 319.38; white solid <i>air sensitive</i>	100mg 500mg
15-7176	(2-Ammonioethyl)di-t-butylphosphonium bis(tetrafluoroborate), min. 97% (1222630-51-4) C ₁₀ H ₂₅ B ₂ F ₈ NP; FW: 363.89; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.	250mg 1g
15-7178	(3-Ammoniopropyl)di-t-butylphosphonium bis(tetrafluoroborate), min. 97% C ₁₁ H ₂₇ B ₂ F ₈ NP; FW: 377.92; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.	250mg 1g
15-1960 NEW	4-(Anthracen-9-yl)-3-(t-butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole, 98+% <i>rac-AntPhos</i> (1268693-24-8) C ₂₈ H ₂₃ O ₃ P; FW: 370.42; pale yellow powdr. <i>air sensitive, (store cold)</i> Note: Sold in collaboration with Zejun for research purposes only. Patents ZL201310020371.1, CN 201610056390.	25mg 100mg 500mg

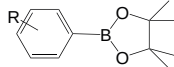


Technical Notes:

1. Ligand/palladium catalyst for general Miyaura borylation reactions.
2. Ligand/palladium catalyst for general and sterically demanding Suzuki-Miyaura cross-coupling reactions.
3. Ligand/palladium catalyst for aryl-alkyl Suzuki-Miyaura cross-coupling reactions.
4. Ligand/nickel catalyst for intramolecular reductive cyclization.
5. Ligand/palladium catalyst for Dearomative cyclization.



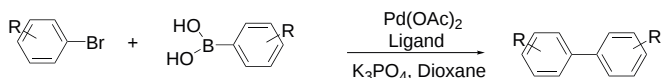
Bedford Pd precursor
Ligand
KOAc, DMAc



Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

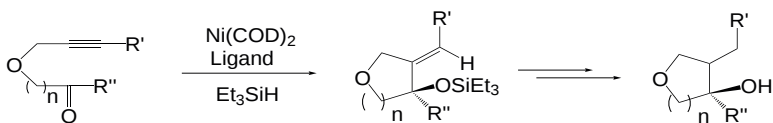
15-1960 (continued) **4-(Anthracen-9-yl)-3-(t-butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole, 98+% rac-AntPhos (1268693-24-8)**



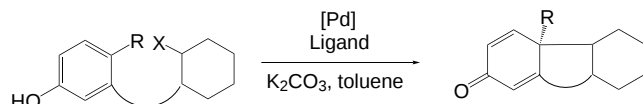
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5,6)

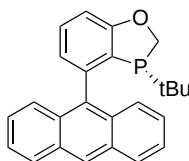
References:

1. *Org. Lett.*, **2011**,13,1366.
2. *Chem. Eur. J.*, **2013**,19,2261.
3. *Org.Chem. Front.*, **2014**,1, 225.
4. *Angew. Chem. Int. Ed.*, **2015**, 54, 2520.
5. *Angew. Chem. Int. Ed.*, **2015**, 54, 3033.
6. *Tetrahedron*, **2016**, 72, 1782.

15-1963

NEW

(R)-4-(Anthracen-9-yl)-3-(t-butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole, 98+% (>99% ee) [(R)-AntPhos] (1456816-37-7)
C₂₅H₂₃O₃P; FW: 370.42; light-yellow xtl.
air sensitive, (store cold)
Note: Sold in collaboration with Zejun for research purposes only. Patents ZL201310020371.1, CN 201610056390.



25mg
100mg
500mg

Technical Note:

1. See 15-1960 (page 1)

15-1967

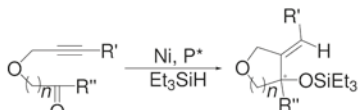
NEW

(S)-4-(Anthracen-9-yl)-3-(t-butyl-2,3-dihydrobenzo[d][1,3]oxaphosphole, 99+% (>99% ee) [(S)-AntPhos] (1807740-34-6)
C₂₅H₂₃O₃P; FW: 370.42; light yellow xtl.
air sensitive, (store cold)
Note: Sold in collaboration with Zejun for research purposes only. Patents ZL201310020371.1, CN 201610056390.

25mg
100mg
500mg

Technical Note:

1. Ligand for the enantioselective nickel-catalyzed intramolecular reductive cyclization of alkyneones.



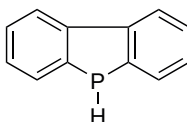
Tech. Note (1)
Ref. (1)

References:

1. *Angew. Chem. Int. Ed.*, **2015**, 54, 2520.

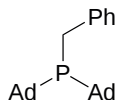
PHOSPHORUS - Ligands and Compounds

15-0033 **5H-Benzo[b]phosphindole, 99% (244-87-1)**
 $C_{12}H_9P$; FW: 184.17; white powdr.
air sensitive



250mg
1g

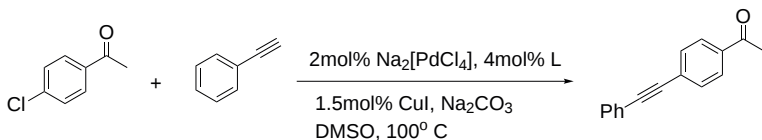
15-0038 **Benzyl-di-1-adamantylphosphine, min. 85% [cataCXium® ABn] (395116-70-8)**
 $C_6H_5CH_2(C_{10}H_{15/2})_2P$; FW: 392.56; yellow powdr.;
 m.p. 183°
air sensitive
 Note: Sold in collaboration with Solvias for research purposes only. Patent WO 0210178. Solvias cataCXium® Ligand Kit component.



500mg
2g

Technical Note:

- Useful ligand for Sonogashira coupling reaction.

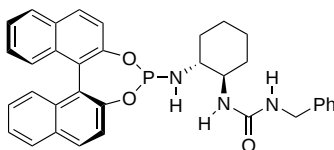


Tech. Note (1)
Ref. (1)

References:

- Angew. Chem. Int. Ed., **2003**, 42, 1056.
- Synthesis, **2004**, 935. (general overview)

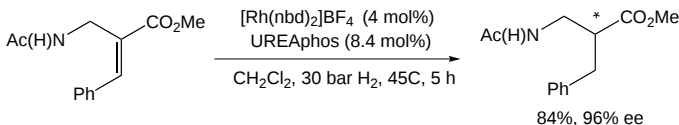
15-2208 **1-Benzyl-3-[(1R,2R)-2-[(11bS)-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-ylamino]cyclohexyl]urea, min. 97% (1198080-57-7)**
 $C_{34}H_{32}N_3O_3P$; FW: 561.61;
 white powdr.
moisture sensitive, (store cold)
 Note: Sold under license from InCatT for research purposes only. WO2004/103559.
 UREAphos and METAMORPhos Ligand Kit component.



50mg
250mg

Technical Note:

- The UREAphos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



References:

- J. Chem. Soc. Chem. Comm., **2007**, 864.
- WO2004103559A2.

15-0040 **Benzylidiphenylphosphine, 99% (7650-91-1)**
 $(C_6H_5CH_2)(C_6H_5)_2P$; FW: 276.32; white powdr.; m.p. 74-75°
air sensitive

1g
5g

PHOSPHORUS - Ligands and Compounds

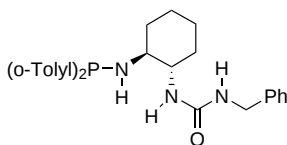
15-2210

1-Benzyl-3-[(1S,2S)-2-(di-o-tolylphosphinoamino)cyclohexyl]urea, min. 97% (1858223-87-6)

$C_{28}H_{34}N_2O$; FW: 459.56; white powdr.

moisture sensitive, (store cold)

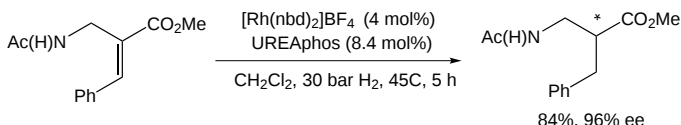
Note: Sold under license from InCatT for research purposes only. WO2004/103559. UREAphos and METAMORPhos Ligand Kit component.



50mg
250mg

Technical Note:

1. The UREAphos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



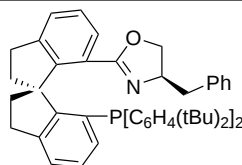
References:

1. J. Chem. Soc. Chem. Comm., 2007, 864.
2. WO2004103559A2.

15-5190

(R)-(+)-7'-[4(S)-(Benzyl)oxazol-2-yl]-7-di(3,5-di-t-butylphenyl)phosphino-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (Ra,S)-DTB-Bn-SIPHOX

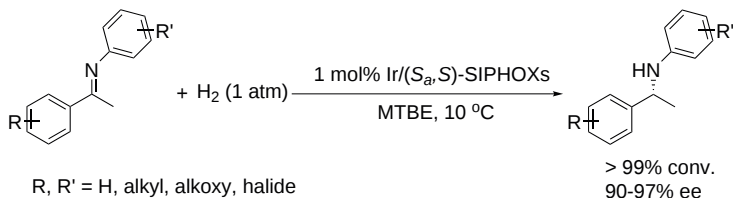
$C_{65}H_{66}NOP$; FW: 788.09; white solid; m.p. 120-121°
moisture sensitive



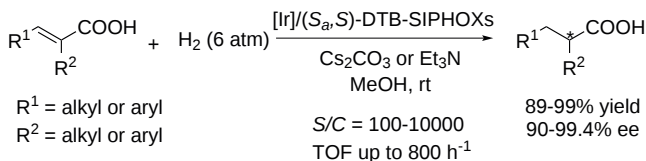
25mg
100mg

Technical Notes:

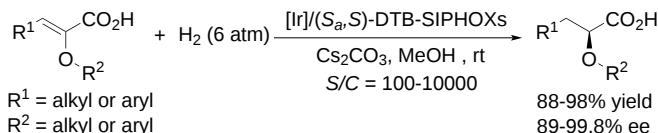
1. Chiral ligands for the iridium-catalyzed, asymmetric hydrogenation of imines.
2. Chiral ligands for the iridium-catalyzed, asymmetric hydrogenation of α - β unsaturated carboxylic acids.
3. Chiral ligands for iridium-catalyzed, asymmetric hydrogenation of α ,-oxy- α,β -unsaturated carboxylic acids.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

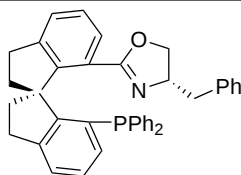
1. J. Am. Chem. Soc., 2006, 128, 12886.
2. J. Am. Chem. Soc., 2008, 130, 8584.
3. J. Am. Chem. Soc., 2010, 132, 1172.

PHOSPHORUS - Ligands and Compounds

15-5191 (S)-(-)-7'-[4(S)-(Benzyl)oxazol-2-yl]-7-di(3,5-di-*t*-butylphenyl)phosphino-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97%
(Sa,S)-DTB-Bn-SIPHOX (1040274-10-9)
C₅₅H₆₆NOP; FW: 788.09; white solid; m.p. 159-161°
moisture sensitive

25mg
100mg

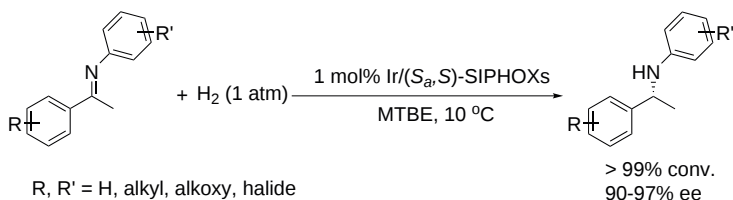
15-5186 (R)-(+)-7-[4(S)-(Benzyl)oxazol-2-yl]-7'-diphenylphosphino-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (Ra,S)-Ph-Bn-SIPHOX
C₃₉H₃₄NOP; FW: 563.67; white solid; m.p. 100-102°
moisture sensitive



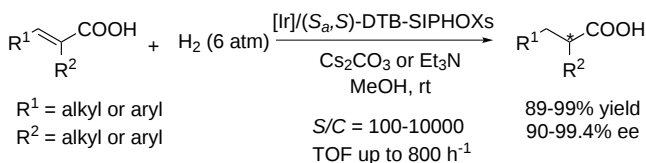
25mg
100mg

Technical Notes:

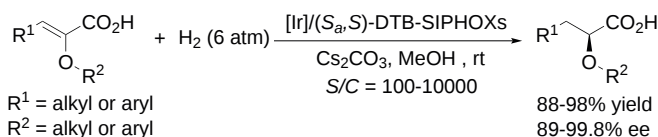
- Chiral ligands for the iridium-catalyzed, asymmetric hydrogenation of imines.
- Chiral ligands for the iridium-catalyzed, asymmetric hydrogenation of α,β unsaturated carboxylic acids.
- Chiral ligands for iridium-catalyzed, asymmetric hydrogenation of α , α -oxy- α,β -unsaturated carboxylic acids.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

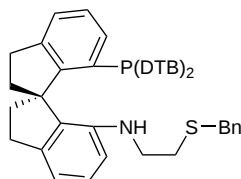
References:

- J. Am. Chem. Soc., **2006**, 128, 12886.
- J. Am. Chem. Soc., **2008**, 130, 8584.
- J. Am. Chem. Soc., **2010**, 132, 1172.

15-5187 (S)-(-)-7'-[4(S)-(Benzyl)oxazol-2-yl]-7-diphenylphosphino-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (Sa,S)-Ph-Bn-SIPHOX
(913829-88-6)
C₃₉H₃₄NOP; FW: 563.67; white solid; m.p. 164-166°
moisture sensitive

25mg
100mg

15-1613 (R)-(+)-7-[N-(2-Benzylthio)ethyl-amino]-7'-[bis(3,5-di-*t*-butylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, 97+% (>99% ee) [(R)-DTB-SpiroSAP-Bn] (1809609-52-6)
C₅₄H₆₈NPS; FW: 794.16; off-white solid
air sensitive



25mg
100mg

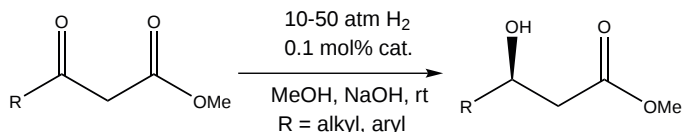
This technical note is for the iridium complex 77-2510. This is an analogous ligand included in the reference below.

PHOSPHORUS - Ligands and Compounds

15-1613 (R)-(+)-7-[N-(2-Benzylthio)ethylamino]-7'-[bis(3,5-di-*t*-butylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobindane, 97+% (>99% ee) [(R)-DTB-SpiroSAP-Bn] (1809609-52-6)
(continued)

Technical Note:

- Catalyst used for the asymmetric hydrogenation of β -alkyl- β -ketoesters.

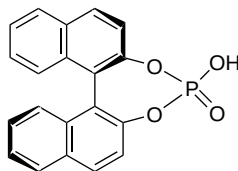


Tech. Note (1)
Ref. (1)

References:

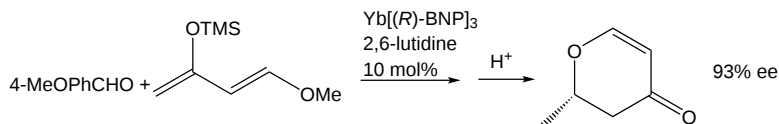
- Angew. Chem. Int. Ed.*, **2015**, 54, 8791

93-1573 HAZ	Benzyltriphenylphosphonium chloride, 99% (1100-88-5) (C ₆ H ₅ CH ₂)(C ₆ H ₅) ₃ PCl; FW: 388.88; white xtl.; m.p. 288°	25g 100g
15-0052	(R)-(-)-1,1'-Binaphthyl-2,2'-diyl hydrogenphosphate, min. 98% (39648-67-4) C ₂₀ H ₁₃ O ₄ P; FW: 348.30; white powdr.	1g 5g

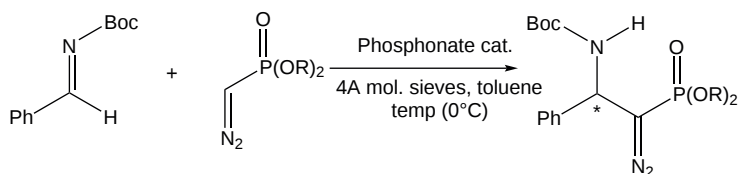


Technical Notes:

- Asymmetric hetero Diels-Alder reaction catalyzed by chiral lanthanide(III) complex.
- Highly efficient Mannich reaction
- Acidic Resolving agent for certain amine/racemic mixtures. (Ref. 3,4)



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

- Org. Lett.*, **2000**, 2, 49.
- Org. Lett.*, **2012**, 14, 2126.
- J. Org. Chem.*, **1991**, 56, 485.
- US 6,162,919.

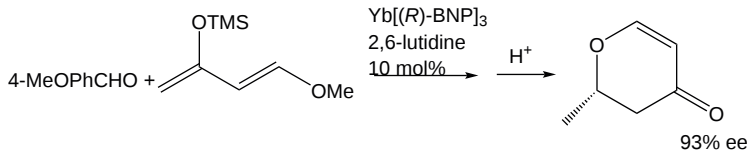
PHOSPHORUS - Ligands and Compounds

15-0053 (S)-(+)-1,1'-Binaphthyl-2,2'-diyl hydrogenphosphate, min. 98%
(35193-64-7)
 $C_{20}H_{13}O_4P$; FW: 348.30; white powdr.

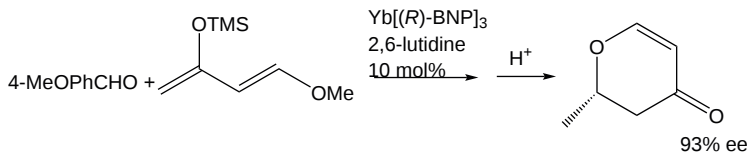
1g
5g

Technical Notes:

1. Asymmetric hetero Diels-Alder reaction catalyzed by chiral lanthanide(III) complex.
2. Highly efficient Mannich reaction
3. Acidic Resolving agent for certain amine/racemic mixtures. (Ref. 3,4)



Tech. Note (1)
Ref. (1)

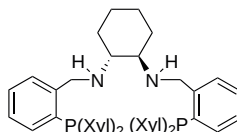


Tech. Note (2)
Ref. (2)

References:

1. *Org. Lett.*, **2000**, 2, 49.
2. *Org. Lett.*, **2012**, 14, 2126.
3. *J. Org. Chem.*, **1991**, 56, 485.
4. US 6,162,919.

15-7320 (1R,2R)-N,N-Bis[2-[bis(3,5-dimethylphenyl)phosphino]benzyl]cyclohexane-1,2-diamine, min. 97%
(1150113-66-8)
 $C_{52}H_{60}N_2P_2$; FW: 774.99; yellow solid
air sensitive

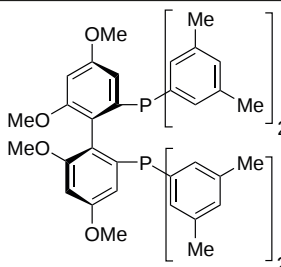


100mg
500mg

15-7321 (1S,2S)-N,N-Bis[2-[bis(3,5-dimethylphenyl)phosphino]benzyl]cyclohexane-1,2-diamine, min. 97%
 $C_{52}H_{60}N_2P_2$; FW: 774.99; yellow solid
air sensitive

100mg
500mg

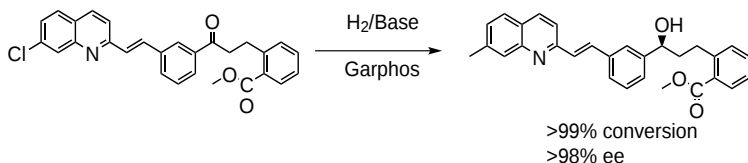
15-1661 (R)-2,2'-Bis[bis(3,5-dimethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97%
(R)-Xyl-Garphos™ (1365531-89-0)
 $C_{48}H_{52}O_4P_2$; FW: 754.87; white xtl.
air sensitive
Note: Sold in collaboration with KCT.
Patent US App No. 61/381,493.
Garphos™ Ligand Kit component.



100mg
500mg

Technical Note:

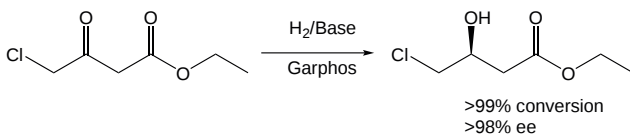
1. Chiral ligand used in the preparation of hydrogenation catalysts with exceptionally high activity and selectivity.



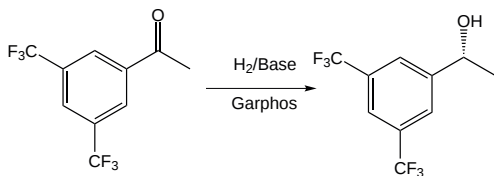
Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-1661 (R)-2,2'-Bis[bis(3,5-dimethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-Xyl-Garphos™ (1365531-89-0)



Tech. Note (2)
Ref. (1)



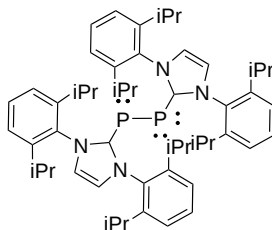
Tech. Note (3)
Ref. (1)

S:C = 100.000:1
>99% conversion
>99% ee

References:

1. US Patent Application No. 61/381,493.

15-1662	(S)-2,2'-Bis[bis(3,5-dimethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (S)-Xyl-Garphos™ (1365531-90-3) C ₄₈ H ₅₂ O ₄ P ₂ ; FW: 754.87; white xtl. <i>air sensitive</i> Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.	100mg 500mg
15-7125	1,2-Bis[1,3-bis(2,6-di-i-propylphenyl)imidazol-2-ylidene]diphosphine, min. 95% (1080030-13-2) C ₅₄ H ₇₂ N ₄ P ₂ ; FW: 839.12; orange-red xtl. <i>air sensitive</i> Note: Sold under license from the University of Georgia Research Foundation, Inc. for research purposes only. US Patent 8,278,456.	50mg 250mg



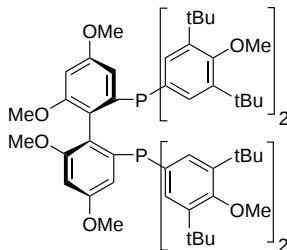
Technical Note:

1. A carbene-stabilized diphosphorus.

References:

1. *Inorg. Chem.*, **2011**, 50, 12326.
2. *J. Am. Chem. Soc.*, **2008**, 130, 14970.

15-1672	(R)-2,2'-Bis[bis(4-methoxy-3,5-di-t-butylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-DTBM-Garphos™ (1365531-98-1) C ₇₆ H ₁₀₈ O ₈ P ₂ ; FW: 1211.61; white xtl. <i>air sensitive, light sensitive</i> Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.	100mg 500mg
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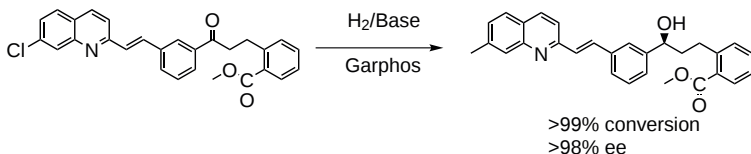


Technical Note:

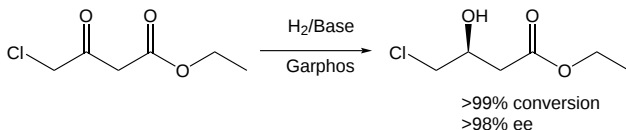
1. Chiral ligand used in the preparation of hydrogenation catalysts with exceptionally high activity and selectivity.

PHOSPHORUS - Ligands and Compounds

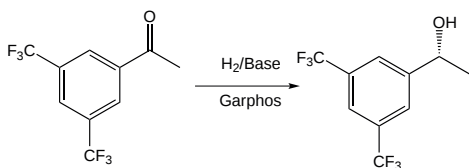
15-1672 (continued) (R)-2,2'-Bis[bis(4-methoxy-3,5-di-*t*-butylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-DTBM-Garphos™ (1365531-98-1)



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (1)



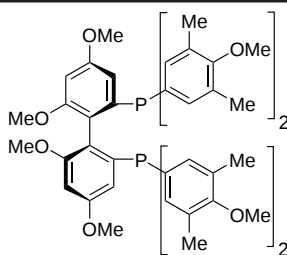
Tech. Note (3)
Ref. (1)

S:C = 100.000:1
>99% conversion
>99% ee

References:

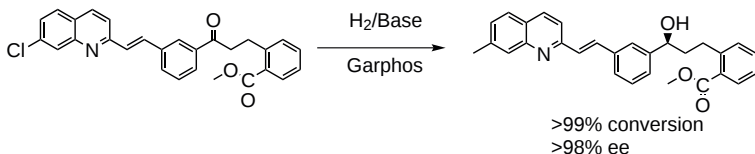
- US Patent Application No. 61/381,493.

15-1673	(S)-2,2'-Bis[bis(4-methoxy-3,5-di- <i>t</i> -butylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (S)-DTBM-Garphos™ (1365531-99-2) $C_{76}H_{108}O_8P_2$; FW: 1211.61; white xtl. <i>air sensitive, light sensitive</i> Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.	100mg 500mg
15-1666	(R)-2,2'-Bis[bis(4-methoxy-3,5-dimethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-DMM-Garphos™ (1365531-93-6) $C_{52}H_{60}O_8P_2$; FW: 874.98; white xtl. <i>air sensitive</i> Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.	100mg 500mg



Technical Note:

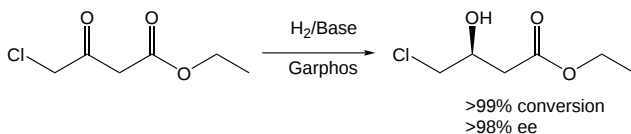
- Chiral ligand used in the preparation of hydrogenation catalysts with exceptionally high activity and selectivity.



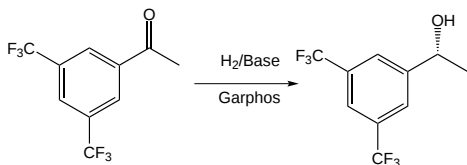
Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-1666 **R)-2,2'-Bis[bis(4-methoxy-3,5-dimethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-DMM-Garphos™**



Tech. Note (2)
Ref. (1)



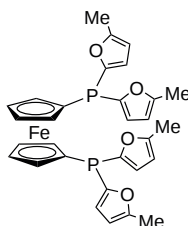
S:C = 100.000:1
>99% conversion
>99% ee

Tech. Note (3)
Ref. (1)

References:

- US Patent Application No. 61/381,493.

15-1667	(S)-2,2'-Bis[bis(4-methoxy-3,5-dimethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (S)-DMM-Garphos™ (1365531-94-7) $C_{52}H_{60}O_8P_2$; FW: 874.98; white xtl. <i>air sensitive</i> Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.	100mg 500mg
26-0320	1,1'-Bis[bis(5-methyl-2-furanyl)phosphino]ferrocene, 98% HiersoPHOS-3 (756824-22-3) $C_{30}H_{28}FeO_4P_2$; FW: 570.33; orange xtl.	100mg 500mg



Technical Note:

- Used in various comparative studies for palladium-promoted catalytic transformations involving polydentate ferrocenylphosphines ligands:
 - Palladium coupling of aniline derivatives with bromo- and chloroarenes ^[1]
 - Palladium-catalyzed formation of secondary and tertiary amines from aryl dihalides ^[2]
 - Palladium-catalyzed arylation of phenols with chloro heteroarenes ^[3]
 - Palladium-catalyzed C–H Bond activation of heteroaromatics furan, thiophene, and thiazole and benzoxazolheterocycles ^[4]

References:

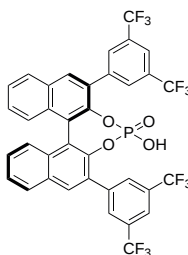
- ChemCatChem*, **2010**, 2, 296.
- Adv. Synth. Catal.*, **2011**, 353, 3403
- Catal. Commun.*, **2014**, 51, 10
- Catal., Sci. Technol.*, **2014**, 4, 2072

PHOSPHORUS - Ligands and Compounds

15-1366

NEW

(11bR)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (791616-62-1)
 $C_{36}H_{17}F_{12}O_4P$; FW: 772.5;
 white to light-yellow powder.
 Note: Sold in collaboration with Daicel for research purposes only.



100mg

15-1367

NEW

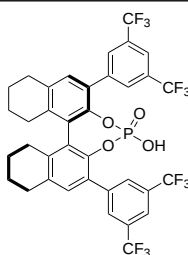
(11bS)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (878111-17-2)
 $C_{36}H_{17}F_{12}O_4P$; FW: 772.5; White to light-yellow powder.
 Note: Sold in collaboration with Daicel for research purposes only.

100mg

15-1376

NEW

(11bR)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (1011465-24-9)
 $C_{36}H_{25}F_{12}O_4P$; FW: 780.5;
 White to light-yellow powder.
 Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

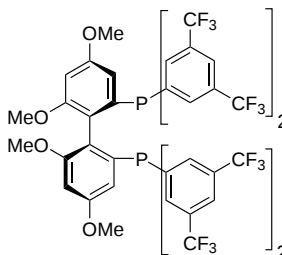
15-1377

(11bS)-2,6-Bis[3,5-bis(trifluoromethyl)phenyl]-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)
 $C_{36}H_{25}F_{12}O_4P$; FW: 780.5; White to light-yellow powder.
 Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-1663

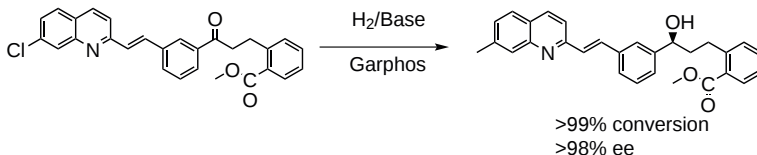
(R)-2,2'-Bis[bis(3,5-trifluoromethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-BTfM-Garphos™ (1365531-84-5)
 $C_{48}H_{28}F_{24}O_4P_2$; FW: 1186.64; white xtl.
air sensitive
 Note: Sold in collaboration with KCT.
 Patent US App No. 61/381,493.
 Garphos™ Ligand Kit component.



100mg
500mg

Technical Note:

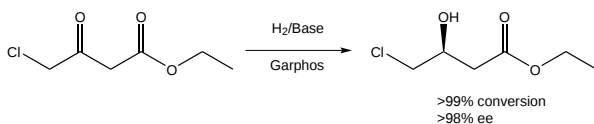
- Chiral ligand used in the preparation of hydrogenation catalysts with exceptionally high activity and selectivity.



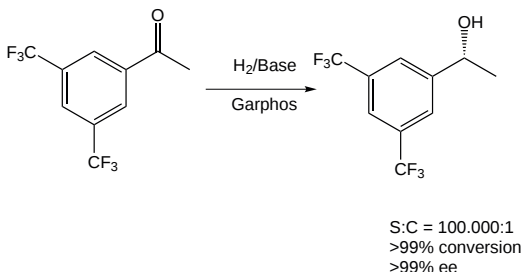
Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-1663 (continued) (R)-2,2'-Bis[bis(3,5-trifluoromethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-BTFM-Garphos™ (1365531-84-5)



Tech. Note (2)
Ref. (1)

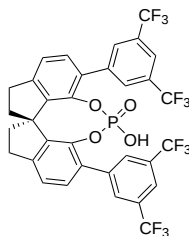


Tech. Note (3)
Ref. (1)

References:

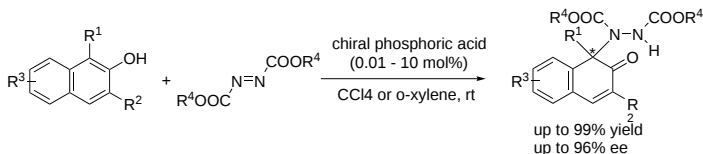
- US Patent Application No. 61/381,493.

15-1664	(S)-2,2'-Bis[bis(3,5-trifluoromethylphenyl)phosphino]-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (S)-BTFM-Garphos™ (1365531-85-6) C ₄₈ H ₂₈ F ₂₄ O ₄ P ₂ ; FW: 1186.64; white xtl. <i>air sensitive</i> Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.	100mg 500mg
15-0527 NEW	(11aR)-3,7-Bis[3,5-bis(trifluoromethyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1297613-76-3) C ₃₃ H ₁₉ F ₁₂ O ₄ P; FW: 738.46; white to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.	25mg 100mg



Technical Note:

- Asymmetric dearomatization of β -naphthols through an amination reaction catalyzed by a chiral phosphoric acid.



Tech. Note (1)
Ref. (1)

References:

- Angew. Chem. Int. Ed., 2015, 54, 647.

15-0528 NEW	(11aS)-3,7-Bis[3,5-bis(trifluoromethyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1258327-07-9) C ₃₃ H ₁₉ F ₁₂ O ₄ P; FW: 738.46; white to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.	25mg 100mg
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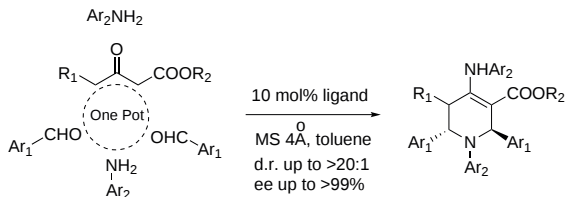
Technical Notes:

- Organocatalytic asymmetric multicomponent reactions of aromatic aldehydes and anilines with β -ketoesters: facile and atom-economical access to chiral tetrahydropyridines.

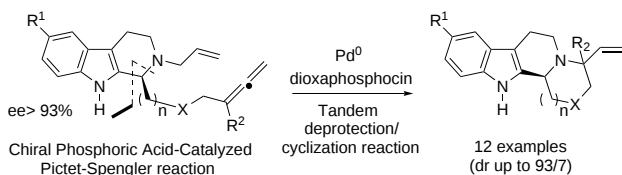
PHOSPHORUS - Ligands and Compounds

15-0528 (11aS)-3,7-Bis[3,5-bis(trifluoromethyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-(continued) diindenol[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1258327-07-9)

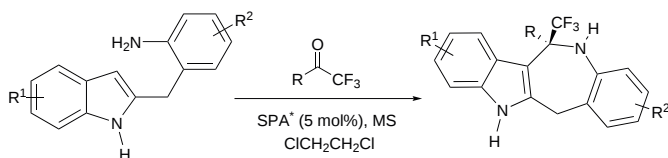
- Pd(0)-catalyzed tandem deprotection/cyclization of tetrahydro- β -carbolines on allenes: application to the synthesis of indolo[2,3- α]quinolizidines.
- Enantioselective synthesis of benzazepinoindoles bearing trifluoromethylated quaternary stereocenters, catalyzed by chiral spirocyclic phosphoric acids.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

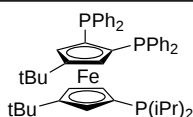


Tech. Note (3)
Ref. (3)

References:

- Chem Commun.*, **2013**, 49, 1401.
- Org. Lett.*, **2014**, 16, 1924.
- Chem Commun.*, **2014**, 50, 7538.

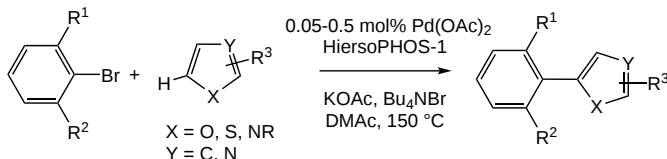
26-0315 1',4-Bis(t-butyl)-1,2-bis(diphenylphosphino)-3'-(di-i-propylphosphino)ferrocene, 98% HiersoPHOS-1 (1313012-94-0)
C₄₈H₅₇FeP₃; FW: 782.73; orange xtl.



100mg
500mg

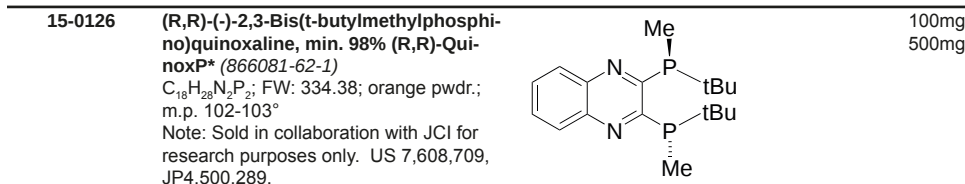
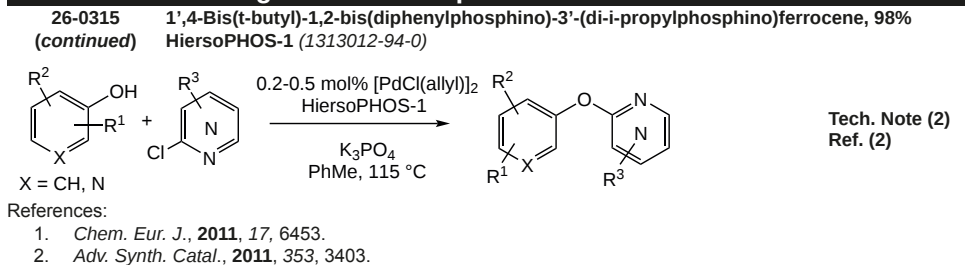
Technical Notes:

- Direct Arylation of Heteroaromatics with Congested, Functionalised Aryl Bromides at Low Palladium Loading (0.05-0.5 mol%):furans, thiophenes, thiazoles, pyrroles functionalized with alkyl, nitrile, aldehyde, keto, and ester groups coupling with ortho- and di-ortho-substituted aryl bromides (phenyl, naphthyl, anthracenyl) bearing alkyl, aryl, alcohol, nitrile, carbonitrile, and ethoxy groups.
- Etherification of Functionalized Phenols with Chloroheteroarenes at Low Palladium Loading (0.2-0.5 mol%): para-, meta- and ortho- mono and di-substituted phenols (bearing methyl, isopropyl, methoxy, fluoro, amino, and ester groups) coupling with chloro-pyridines, -quinolines, -hydroxypyridines, -pyrimidines, -thiazoles bearing electron-withdrawing or -donating cyano and methoxy groups.



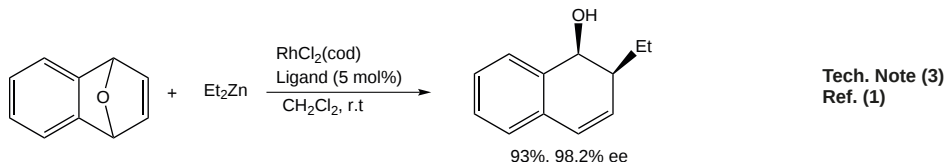
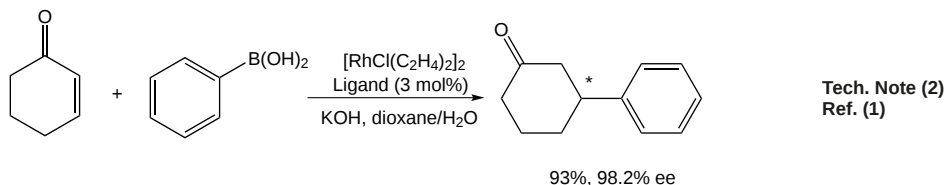
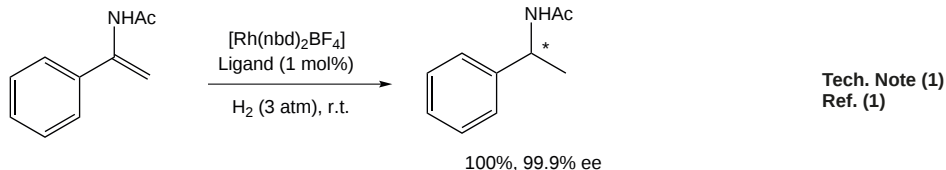
Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds



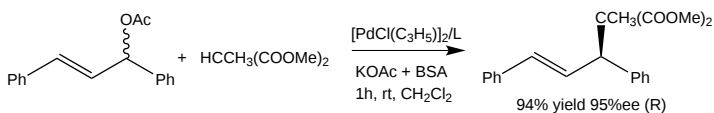
Technical Notes:

- Ligand for the rhodium-catalyzed, asymmetric hydrogenation of dehydroamino acid esters and α-enamides.
- Ligand for the rhodium-catalyzed, asymmetric 1,4-addition of arylboronic acids to α,β-unsaturated carbonyl compounds.
- Ligand for the rhodium-catalyzed, asymmetric alkylative ring opening reaction
- Ligand for the palladium-catalyzed asymmetric allylic alkylation and amination of racemic substrates.
- Ligand for the ruthenium-catalyzed asymmetric hydrogenation of ketones.
- Ligand for the rhodium-catalyzed, asymmetric hydroacylation of 1,1-disubstituted alkenes with aldehydes.
- Ligand for the silver-catalyzed asymmetric nitroso aldol reaction.
- Cu-catalyzed enantioconvergent allylic borylation.
- Cu-catalyzed enantioselective cyclopropylation.

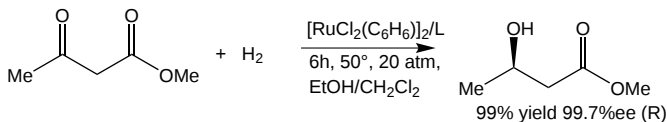


PHOSPHORUS - Ligands and Compounds

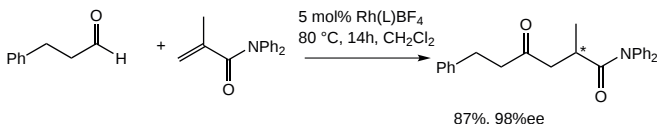
15-0126 (R,R)-(-)-2,3-Bis(t-butylmethylphosphino)quinoxaline, min. 98% (R,R)-QuinoxP*
(continued) (866081-62-1)



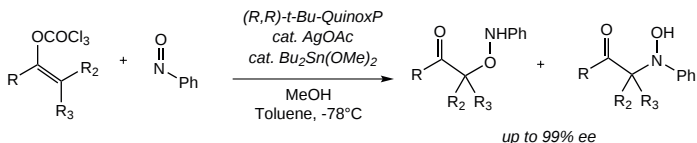
Tech. Note (4)
Ref. (2)



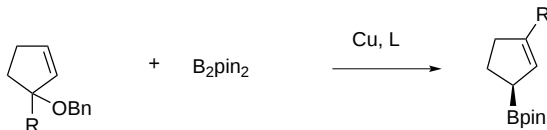
Tech. Note (5)
Ref. (2)



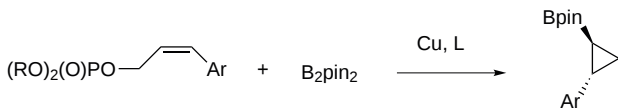
Tech. Note (6)
Ref. (3)



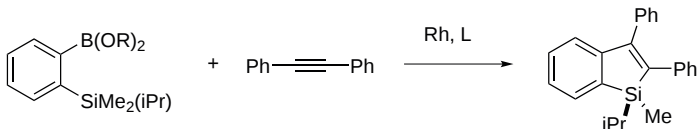
Tech. Note (7)
Ref. (4)



Tech. Note (8)
Ref. (5)



Tech. Note (9)
Ref. (6)



Tech. Note (10)
Ref. (7)

References:

1. J. Am. Chem. Soc., **2005**, 127, 11934.
2. J. Org. Chem., **2007**, 72, 7413.
3. J. Am. Chem. Soc., **2009**, 131, 12552.
4. J. Am. Chem. Soc., **2009**, 132, 5328.
5. Nat. Chem. **2010**, 2, 972.
6. J. Am. Chem. Soc., **2010**, 132, 11440.
7. J. Am. Chem. Soc., **2012**, 134, 19477.

15-0127 (S,S)-(+)-2,3-Bis(t-butylmethylphosphino)quinoxaline, min. 98%
(S,S)-QuinoxP* (1107608-80-9)
C₁₈H₂₈N₂P₂; FW: 334.38; orange powdr.; m.p. 102-103°
Note: Sold in collaboration with JCI for research purposes only. US
7,608,709, JP4,500,289.

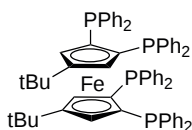
100mg
500mg

PHOSPHORUS - Ligands and Compounds

26-0326

4,4'-Bis(t-butyl)-1,1',2,2'-tetrakis(diphenylphosphino)ferrocene, 98% HiersoPHOS-5
(403815-19-0)

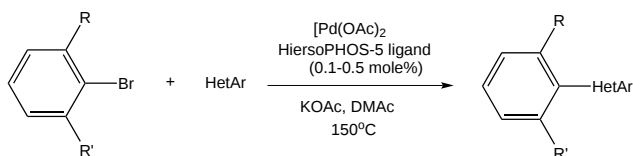
C₆₆H₆₂FeP₄; FW: 1034.94; orange xtl.



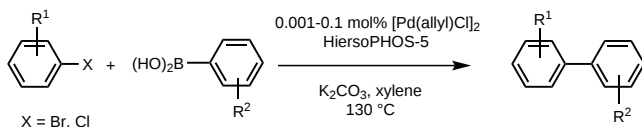
100mg
500mg

Technical Notes:

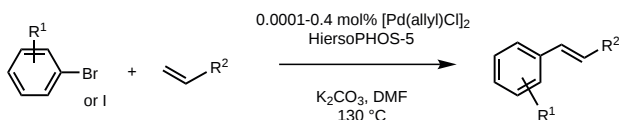
1. Ligand/palladium complex used in the direct arylation of heteroaromatic compounds with congested, functionalized aryl bromides.
2. Suzuki-Miyaura Coupling of Aryl Bromides and Chlorides bearing alkyl, methoxy, keto, nitrile, etc. substitution to phenyl- and methoxybenzene boronic acids at Low Palladium Loading.
3. Heck Coupling of Functionalized Aryl Bromides to n-butyl acrylate, styrene and n-butyl vinyl ether at Low Palladium Loading.
4. Additional catalyzed reaction include Allylic Amination of Monoterpene Derivatives including geranylacetate, nerylacetate, linalylacetate and perillylacetate at Low Palladium Loading (0.001-1.0 mol%, Ref.2), and Sonogashira Cross-Coupling of Aryl Bromides by using stabilizing new copper-tetraphosphane adducts (Ref. 3).



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)

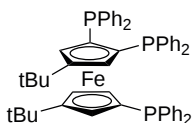
References:

1. *Chemistry – A European Journal*, **2011**, 17, 23, 6453
2. *Organometallics*, **2003**, 22, 4490
3. *Appl. Organometal. Chem.*, **2006**, 20, 845
4. *Organometallics*, **2008**, 27, 1506

26-0318

1',4-Bis(t-butyl)-1,2,3'-tris(diphenylphosphino) ferrocene, 98% HiersoPHOS-2
(1159850-42-6)

C₅₄H₅₃FeP₃; FW: 850.77; orange xtl.



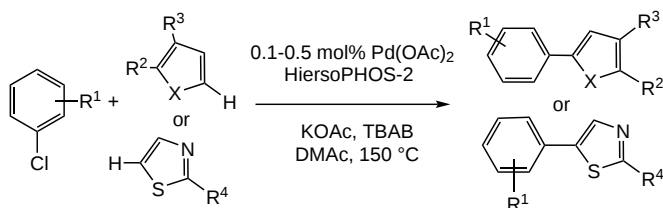
100mg
500mg

Technical Notes:

1. Direct Arylation of Heteroaromatics with Functionalized Aryl Chlorides at Low Palladium Loading (0.1-0.5 mol%): furans, thiophenes, thiazoles, pyrroles functionalized with alkyl, ester, nitrile, and aldehyde groups coupling with para-, meta- and ortho-substituted chloroarenes bearing alkyl, formyl, nitriles, nitro, keto and ester groups.
2. Additional catalyzed reactions include Sonogashira Cross-Coupling of Aryl Bromides and Chlorides at Low Palladium and Copper Iodide Loading (0.05 to 0.4 mol%) by using stabilizing new copper-triphosphane adducts (Ref. 2).

PHOSPHORUS - Ligands and Compounds

26-0318 1',4-Bis(t-butyl)-1,2,3'-tris(diphenylphosphino) ferrocene, 98% HiersoPHOS-2
(continued) (1159850-42-6)



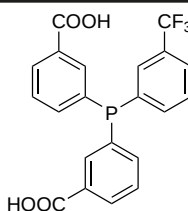
X = O, S, N-R⁵

References:

1. *Angew. Chem. Int. Ed.*, **2010**, 49, 6650.
2. *Organometallics*, **2010**, 29, 2815.

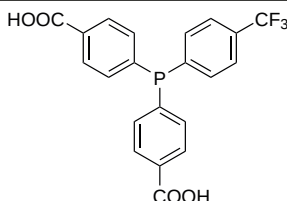
Tech. Note (1)
Ref. (1)

15-0270 **Bis(3-carboxyphenyl)(3-trifluoromethyl-phenyl)phosphine, min. 97% m-Miran2phos (1808959-39-8)**
C₂₁H₁₄F₃O₄P; FW: 418.30; white powdr.
Note: Sold under license from UAB for research purposes only. Spanish Patent Application P201231702.



100mg
500mg

15-0268 **Bis(4-carboxyphenyl)(4-trifluoromethylphenyl)phosphine, min. 97% p-Miran2phos**
C₂₁H₁₄F₃O₄P; FW: 418.30; white solid
Note: Sold under license from UAB for research purposes only. Spanish Patent Application P201231702.

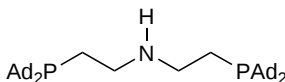


100mg
500mg

15-0075 **Bis(2-cyanoethyl)phenylphosphine, min. 97% (15909-92-9)**
(NCCH₂CH₂)₂(C₆H₅)P; FW: 216.22; colorless xtl.; m.p. 72-73°; b.p. 176-178°/0.5 mm
air sensitive

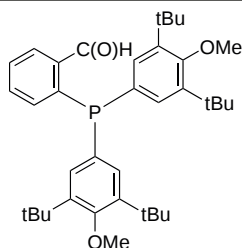
1g
5g

15-7312 **Bis[2-(di-1-adamantylphosphino)ethyl]amine, min. 97% (1086138-36-4)**
C₄₄H₆₉NP₂; FW: 673.97; white solid
air sensitive
Note: Sold under license from Kanata for research purposes only. WO 2004096735.



250mg
1g

15-7338 **2-[Bis(3,5-di-t-butyl-4-methoxyphenyl)phosphino]benzaldehyde, min. 97% (1202865-21-1)**
C₃₇H₅₁O₃P; FW: 574.77; yellow solid



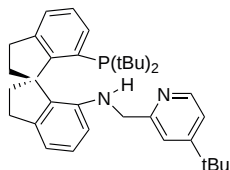
100mg
500mg

PHOSPHORUS - Ligands and Compounds

15-5147

NEW

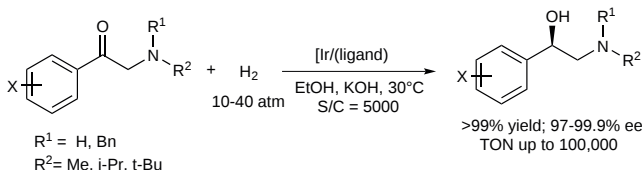
(R)-(+)-7-Bis(3,5-di-*t*-butylphenyl)phosphino-7'-[(4-*t*-butylpyridine-2-ylmethyl)amino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 98% (>99% ee) (R)-DTB-SpiroPAP-4-*t*-Bu (1298133-38-6)
C₅₅H₇₁N₂P; FW: 791.14; white solid;
m.p. 86-88°
air sensitive



25mg
100mg

Technical Note:

- Enantioselective synthesis of chiral 1,2-amino alcohols via asymmetric hydrogenation of α -amino ketones with chiral spiro iridium catalysts.



Tech. Note (1)
Ref. (1)

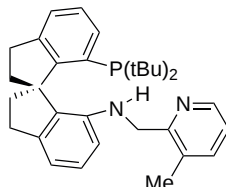
References:

- Synthesis*, **2014**, 46, 2910.

15-5158

NEW

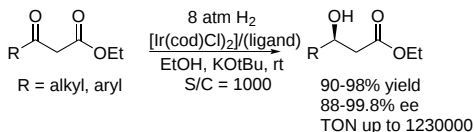
(R)-(+)-7-Bis(3,5-di-*t*-butylphenyl)phosphino-7'-[(3-methylpyridine-2-ylmethyl)amino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 98% (>99% ee) (R)-DTB-SpiroPAP-3-Me (1298133-36-4)
C₅₂H₆₅N₂P; FW: 749.06;
white to off-white solid; m.p. 160-161°
air sensitive



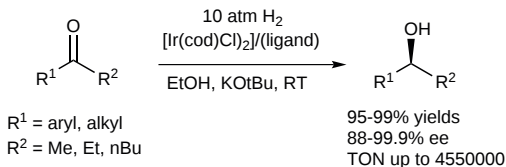
25mg
100mg

Technical Notes:

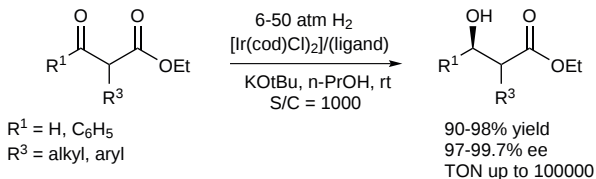
- Iridium/ligand catalyst for the highly efficient, asymmetric hydrogenation of β -aryl and β -ketoesters.
- Extremely efficient chiral iridium catalyst used for the asymmetric hydrogenation of ketones.
- Iridium/ligand catalyst for the highly efficient, asymmetric hydrogenation of β -aryl and β -ketoesters.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

- Angew. Chem Int. Ed.*, **2011**, 50, 7329.
- Angew. Chem Int. Ed.*, **2012**, 51, 201.
- Org. Lett.*, **2012**, 14, 6158.

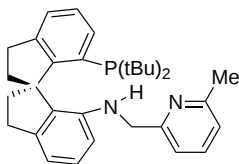
PHOSPHORUS - Ligands and Compounds

15-5148

NEW

(R)-(+)-7-Bis(3,5-di-*t*-butylphenyl)phosphino-7'-[(6-methylpyridine-2-ylmethyl)amino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 98% (>99% ee) (R)-DTB-SpiroPAP-6-Me (1298133-26-2)

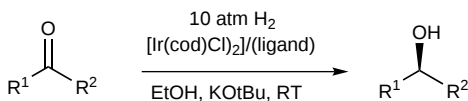
C₅₂H₆₅N₂P; FW: 749.06; white solid; m.p. 153-155°
air sensitive



25mg
100mg

Technical Note:

- Extremely efficient chiral indium catalyst used for the asymmetric hydrogenation of ketones.



R¹ = aryl, alkyl
R² = Me, Et, *n*Bu

95-99% yields
88-99.9% ee
TON up to 4550000

Tech. Note (1)
Ref. (1)

References:

- Angew. Chem. Int. Ed., **2011**, 50, 7329.

15-5159

NEW

(S)-(-)-7-Bis(3,5-di-*t*-butylphenyl)phosphino-7'-[(3-methylpyridine-2-ylmethyl)amino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 98% (>99% ee) (S)-DTB-SpiroPAP-3-Me (1298133-21-7)
C₅₂H₆₅N₂P; FW: 749.06; white to off-white solid; m.p. 162-164°
air sensitive

25mg
100mg

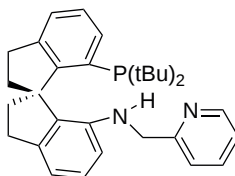
Technical Note:

- See 15-5158 (page 18)

15-5166

NEW

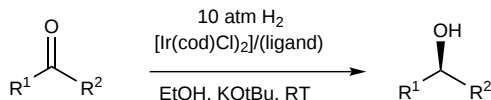
(R)-(+)-7-Bis(3,5-di-*t*-butylphenyl)phosphino-7'-[(pyridine-2-ylmethyl)amino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 98% (>99% ee) (R)-DTB-SpiroPAP (1298133-21-7)
C₅₁H₆₃N₂P; FW: 735.03; white solid; m.p. 172-174°
air sensitive



25mg
100mg

Technical Note:

- Extremely efficient chiral iridium catalyst used for the asymmetric hydrogenation of ketones.



R¹ = aryl, alkyl
R² = Me, Et, *n*Bu

95-99% yields
88-99.9% ee
TON up to 4550000

Tech. Note (1)
Ref. (1)

References:

- Angew. Chem. Int. Ed., **2011**, 50, 7329

PHOSPHORUS - Ligands and Compounds

15-5167

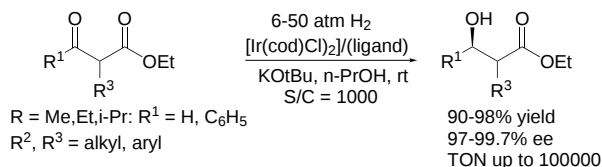
NEW

(S)-(-)-7-Bis(3,5-di-*t*-butylphenyl)phosphino-7'-[(pyridine-2-ylmethyl)amino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 98% (>99% ee)
(S)-DTB-SpiroPAP (1415636-82-6)
 $C_{51}H_{63}N_2P$; FW: 735.03; white solid; m.p. 170-171°
air sensitive

25mg
100mg

Technical Note:

1. Iridium/ligand catalyst for the highly efficient, asymmetric hydrogenation of β -aryl and β -ketoesters.



Tech. Note (1)
Ref. (1)

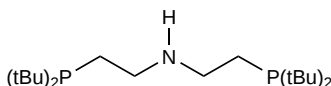
References:

1. *Org. Lett.*, **2012**, *14*, 6158.

15-7309

Bis[2-(di-*t*-butylphosphino)ethyl]amine, min. 97% (10wt% in hexanes)
(944710-34-3)
 $C_{20}H_{45}NP_2$; FW: 361.53;
colorless liq.
air sensitive

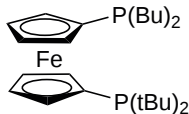
Note: Sold under license from
Kanata for research purposes only.
WO 2004096735.



5g
25g

26-0150

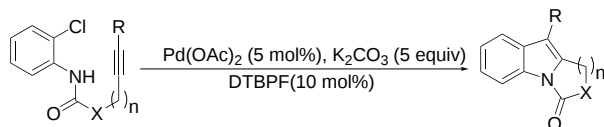
1,1'-Bis(di-*t*-butylphosphino)ferrocene, min. 98% DTBPF (84680-95-5)
[(C₄H₉)₂PC₅H₄]₂Fe; FW: 474.42; orange to red xtl.
Note: 1,1'-Bis(dialkyl/diarylphosphino)ferrocene Ligand Kit component.



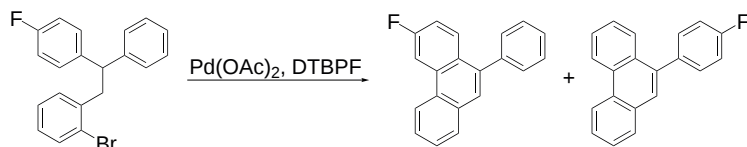
500mg
2g
10g

Technical Notes:

1. Ligand for synthesis of polycyclic indoles via Pd-catalyzed intramolecular heteroannulation.
2. Ligand for the palladium-catalyzed intramolecular arylation of aryl bromides under mild conditions.
3. Ligand for cross-coupling reactions between bromoarenes and potassium allyltrifluoroborates promoted by a catalyst prepared from Pd(OAc)₂ and DTBPF selectively providing γ -coupling products.
4. Ligand for the copper-catalyzed system for the β -boration of a variety of α,β -unsaturated amides.
5. Ligand for the synthesis of Paucifloral F and related indanone analogues via palladium-catalyzed α -arylation.
6. Ligand for the Pd-carbon monoxide complex catalyzed hydroxycarbonylation of aryl halides.
7. Ligand for the palladium-catalyzed b-C-glycosylation by decarboxylative allylation to normal pyran systems, and cis-2,6-disubstituted tetrahydropyrans.
8. Pd-catalyzed dearomative indole bisfunctionalization via a diastereoselective arylation.
9. Ligand for the copper- DTBPF catalyzed C-H activation and carboxylation of terminal alkynes.



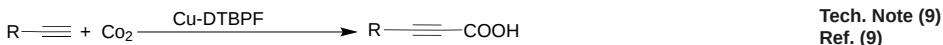
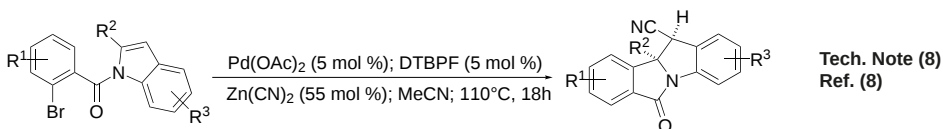
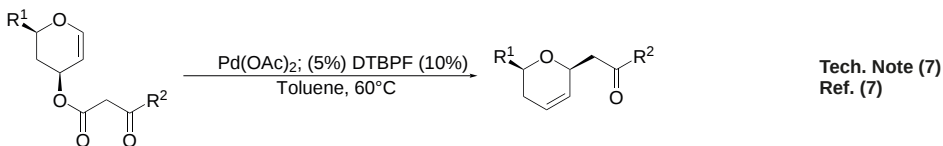
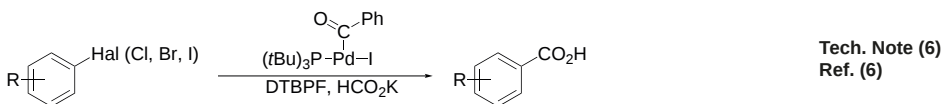
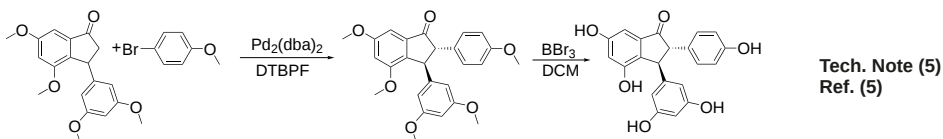
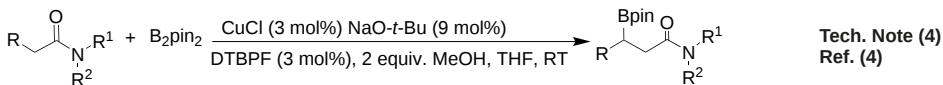
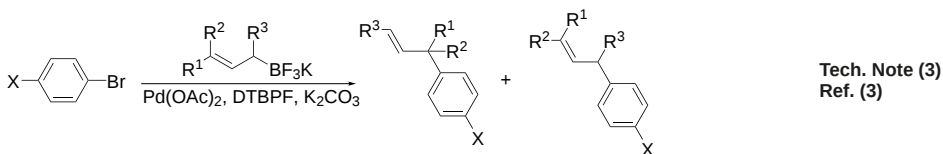
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

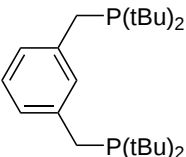
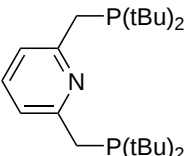
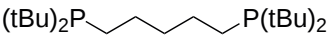
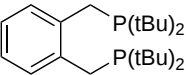
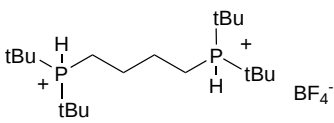
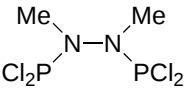
26-0150 1,1'-Bis(di-*t*-butylphosphino)ferrocene, min. 98% DTBPF (84680-95-5)
(continued)



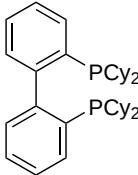
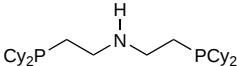
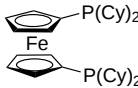
References:

1. *Org. Lett.*, **2006**, 8, 3573.
2. *Tetrahedron*, **2008**, 64, 6021.
3. *Organometallics*, **2009**, 28, 152.
4. *Adv. Synth. Catal.*, **2009**, 351, 855.
5. *J. Org. Chem.*, **2011**, 76, 1902.
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8. *Org. Lett.*, **2015**, 17, 4838.
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PHOSPHORUS - Ligands and Compounds

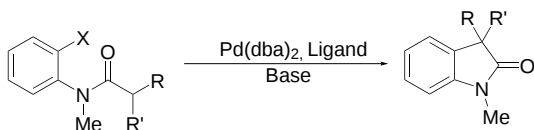
15-0065	1,3-Bis(di-t-butylphosphinomethyl) benzene, 99% (149968-36-5) $C_6H_4[CH_2P(C_4H_9)_2]_2$; FW: 394.56; white powdr. <i>air sensitive</i>		250mg 1g
15-0063	2,6-Bis(di-t-butylphosphinomethyl) pyridine, 99% (338800-13-8) $C_5H_4N[CH_2P(C_4H_9)_2]_2$; FW: 395.54; white to light-yellow powdr. <i>air sensitive</i>		250mg 1g
15-0061	1,5-Bis(di-t-butylphosphino)pentane, min. 97% (65420-68-0) $(C_4H_9)_2P(CH_2)_5P(C_4H_9)_2$; FW: 360.54; colorless, viscous liq. <i>air sensitive</i>		500mg 2g
Technical Note:			
1. Ligand used in the preparation of an iridium compound capable of oxidatively adding ammonia to form a stable, monomeric amido hydride complex.			
References:			
1. <i>Science</i> , 2005 , 307, 1080.			
15-0072	α, α'-Bis(di-t-butylphosphino)-o-xylene, min. 97% (121954-50-5) $C_6H_4[CH_2P(C_4H_9)_2]_2$; FW: 394.56; white xtl.; m.p. 59-62° <i>air sensitive</i>		500mg 2g
15-9582	1,4-Bis(di-t-butylphosphonium)butane bis(tetrafluoroborate), min. 97% $(C_4H_9)_2PH^+CH_2CH_2CH_2CH_2PH^+(C_4H_9)_2$ (BF ₄) ₂ ; FW: 522.14; white solid; m.p. 257-259°		1g 5g
15-0069 amp	1,2-Bis(dichlorophosphino)benzene, min. 97% (82495-67-8) $C_6H_4Cl_2P_2$; FW: 279.85; colorless to pale yellow liq. <i>moisture sensitive</i>		500mg 2g
15-0076 amp HAZ	1,2-Bis(dichlorophosphino)-1, 2-dimethylhydrazine, min. 98% (37170-64-2) $Cl_2PN(CH_3)N(CH_3)PCl_2$; FW: 261.84; colorless to slightly cloudy liq. <i>air sensitive, moisture sensitive</i>		2g 10g
Technical Notes:			
1. Nucleophilic substitution reactions on 15-0076 are so versatile that careful control of the basicity and steric effects of the phosphorus centers are achievable by systematic tuning of the substituents.			
2. The reaction of bis(hydrazido)phosphines with transition metal/organometallic precursors have generated a wide spectrum of coordination compounds. Mononuclear chelates of W(O), Mo(O), Pt(II) and Pd(II) can be prepared.			
3. The N-N bond demonstrates remarkable thermal and hydrolytic stability.			
References:			
1. <i>Inorg. Chem.</i> , 1994 , 33, 2695.			
2. <i>Chem. Ber.</i> , 1994 , 127, 1335.			
3. <i>Inorg. Chem.</i> , 1995 , 34, 5483			

PHOSPHORUS - Ligands and Compounds

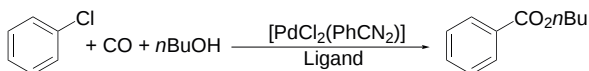
15-0082	1,2-Bis(dichlorophosphino)ethane, min. 97% (28240-69-9)	2g
amp	$\text{Cl}_2\text{PCH}_2\text{CH}_2\text{PCl}_2$; FW: 231.81; colorless to pale yellow liq.;	10g
HAZ	b.p. 70°/1 mm; d. 1.536	50g
	<i>air sensitive, moisture sensitive</i>	
15-0081	Bis(dichlorophosphino)methane, min. 90% (28240-68-8)	2g
amp	$\text{Cl}_2\text{PCH}_2\text{PCl}_2$; FW: 217.78; colorless liq.; b.p. 101-105°/22mm; d. 1.601	10g
HAZ	<i>air sensitive, moisture sensitive</i>	
15-0116	Bis(dichlorophosphino)methylamine, min. 97% (17648-16-7)	500mg
amp	$\text{CH}_3\text{N}(\text{PCl}_2)_2$; FW: 232.80; colorless to pale yellow liq.	2g
HAZ	<i>moisture sensitive</i>	
15-9560	2,2'-Bis(dicyclohexylphosphino)-1,1'-biphenyl, min. 97% (255897-36-0)	250mg
	$\text{C}_{36}\text{H}_{52}\text{P}_2$; FW: 546.75; white to pale yellow pwdr.	1g
		
15-9585	1,2-Bis(dicyclohexylphosphino)ethane, min. 98% (23743-26-2)	1g
	$(\text{C}_6\text{H}_{11})_2\text{PCH}_2\text{CH}_2\text{P}(\text{C}_6\text{H}_{11})_2$; FW: 422.61; white xtl.; m.p. 96-97°	5g
	<i>air sensitive</i>	
15-7310	Bis[2-(dicyclohexylphosphino)ethyl] amine, min. 97% (550373-32-5)	250mg
	$\text{C}_{28}\text{H}_{53}\text{NP}_2$; FW: 465.67; white solid	1g
	<i>air sensitive</i>	
	Note: Sold under license from Kanata for research purposes only. WO 2004096735.	
		
26-0155	1,1'-Bis(dicyclohexylphosphino)ferrocene, min. 98% (146960-90-9)	500mg
	$[(\text{C}_6\text{H}_{11})_2\text{P}(\text{C}_6\text{H}_4)]_2\text{Fe}$; FW: 578.57; orange pwdr.;	2g
	m.p. 138°	10g
	Note: 1,1'-Bis(dialkyl/diarylphosphino)ferrocene Ligand Kit component.	
		

Technical Notes:

- Ligand for palladium-catalyzed synthesis of oxindoles by amide α -arylation
- Ligand for palladium-catalyzed alkoxycarbonylation of aryl chlorides.
- Ligand for ruthenium-catalyzed alcohol-allene C-C coupling reaction via hydrohydroxyalkylation of 1,1-disubstituted allenes employing alcohols.
- Ligand for nickel-catalyzed cross-coupling reaction of arylboronic acids with aryl carbonates.
- Ligand for palladium-catalyzed regiodivergent hydroesterification of aryl olefins with phenyl formate to form linear structured phenyl arylpropanoates.
- Ligand for palladium-catalyzed direct borylation of benzyl alcohol and its analogues in the absence of bases.



Tech. Note (1)
Ref. (1)



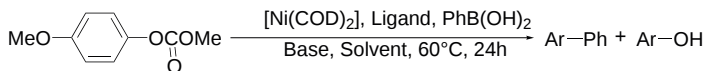
Tech. Note (2)
Ref. (2)



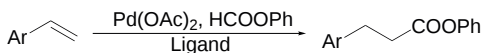
Tech. Note (3)
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PHOSPHORUS - Ligands and Compounds

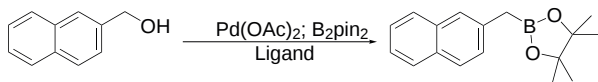
26-0155 1,1'-Bis(dicyclohexylphosphino)ferrocene, min. 98% (146960-90-9)
(continued)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)

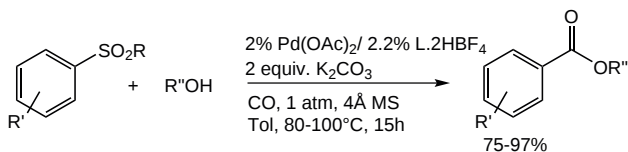
References:

1. J. Org. Chem., **2001**, 66, 3402.
2. J. Organometal. Chem., **2002**, 641, 30.
3. J. Am. Chem. Soc., **2011**, 133, 1141.
4. Chem. Lett., **2011**, 40, 913
5. Org. Chem. Front., **2015**, 2, 1505.
5. Org. Lett., **2015**, 17, 3544.

15-9590	Bis(dicyclohexylphosphino)methane, min. 97% (137349-65-6) (C ₆ H ₁₁) ₂ PCH ₂ P(C ₆ H ₁₁) ₂ ; FW: 408.59; white xtl. <i>air sensitive</i>	1g 5g
15-0048	Bis(2-dicyclohexylphosphinophenyl)ether, 98% (434336-16-0) C ₃₆ H ₅₂ OP ₂ ; FW: 562.75; white powdr.	500mg 2g
15-9562	1,4-Bis(dicyclohexylphosphonium)butane bis(tetrafluoroborate), min. 97% (1389309-54-9) (C ₆ H ₁₁) ₂ PH ⁺ CH ₂ CH ₂ CH ₂ CH ₂ PH ⁺ (C ₆ H ₁₁) ₂ (BF ₄) ₂ ; FW: 626.29; white solid; m.p. 236-238°	1g 5g
15-9558	1,2-Bis(dicyclohexylphosphonium)ethane bis(tetrafluoroborate), min. 97% (1779389-90-0) C ₂₆ H ₅₀ B ₂ F ₈ P ₂ ; FW: 598.23; white solid; m.p. 236-239°	1g 5g
15-9593	1,3-Bis(dicyclohexylphosphonium)propane bis(tetrafluoroborate), min. 97% (1002345-50-7) [(C ₆ H ₁₁) ₂ PCH ₂ CH ₂ CH ₂ P(C ₆ H ₁₁) ₂] ⁺ ·2HBF ₄ ⁻ FW: 612.26; white powdr. <i>hygroscopic</i>	1g 5g

Technical Notes:

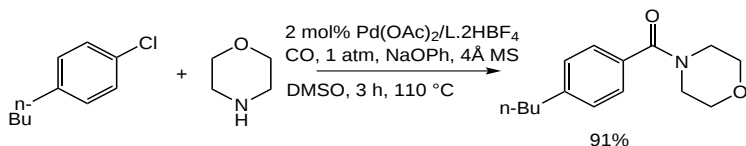
1. Ligand for palladium-catalyzed carbonylation of aryl tosylates and mesylates
2. Ligand for palladium-catalyzed aminocarbonylation of aryl chlorides at atmospheric pressure.



Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-9593 **1,3-Bis(dicyclohexylphosphonium)propane bis(tetrafluoroborate), min. 97%**
(continued) **(1002345-50-7)**



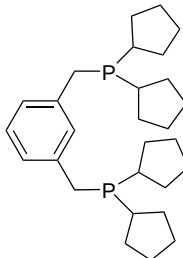
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References:

1. J. Am. Chem. Soc., **2008**, 130, 2754.
2. Angew. Chem. Int. Ed., **2007**, 46, 8460.

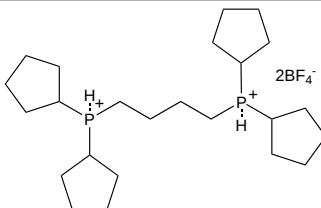
15-9595 **1,3-Bis(dicyclopentylphosphinomethyl) benzene, 99% (255874-48-7)**
 C₆H₄[CH₂P(C₅H₉)₂]₂; FW: 442.60;
 white, waxy solid
 air sensitive

250mg
 1g



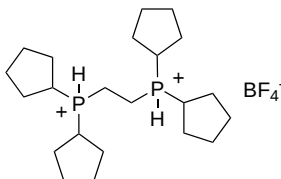
15-9574 **1,4-Bis(dicyclopentylphosphonium)butane bis(tetrafluoroborate), min. 97% (1799401-51-6)**
 (C₅H₉)₂P⁺HCH₂CH₂CH₂CH₂P⁺H(C₅H₉)₂(BF₄)₂;
 FW: 570.18; white solid;
 m.p. 195-197°

1g
 5g



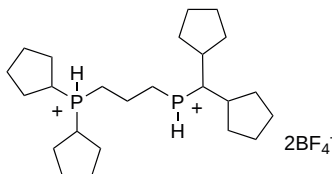
15-9568 **1,2-Bis(dicyclopentylphosphonium) ethane bis(tetrafluoroborate), min. 97% (1799401-52-7)**
 (C₅H₉)₂P⁺HCH₂CH₂P⁺H(C₅H₉)₂(BF₄)₂;
 FW: 542.13; white solid; m.p. 230-233°

1g
 5g



15-9572 **1,3-Bis(dicyclopentylphosphonium) propane bis(tetrafluoroborate), min. 97% (1799401-53-8)**
 (C₅H₉)₂P⁺HCH₂CH₂CH₂P⁺H(C₅H₉)₂(BF₄)₂;
 FW: 556.15; white powdr.;
 m.p. 141-143°

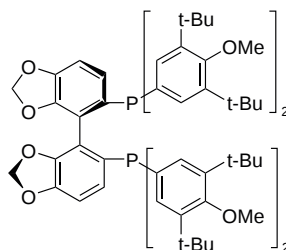
1g
 5g



PHOSPHORUS - Ligands and Compounds

15-0066

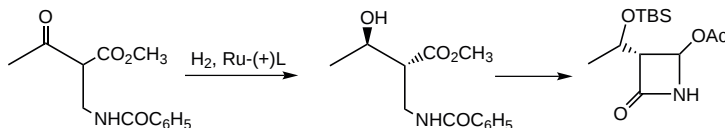
(R)-(-)-5,5'-Bis[di(3,5-di-*t*-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98%
(R)-(-)-DTBM-SEGPHOS® (566940-03-2)
 $C_{74}H_{100}O_8P_2$; FW: 1179.53; off-white powdr.;
 m.p. 126-128°
 Note: Manufactured under license of Takasago patent. Takasago SEGPHOS® Ligand Kit component.



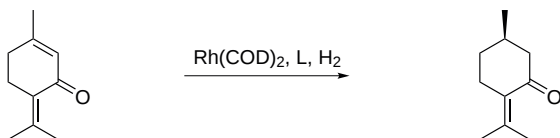
250mg
 1g
 5g

Technical Notes:

1. Biaryl bisphosphine ligand with narrow dihedral angle. The DTBM SEGPHOS® ligand, as the ruthenium complex, gives superior enantioselectivity and diastereoselectivity through dynamic kinetic resolution in the asymmetric hydrogenation of α -substituted- β -ketoesters useful in the synthesis of carbapenem antibiotics.¹
2. With rhodium, preferential enantioselective hydrogenation of more reactive olefin of extended enone structure.²
3. Rhodium catalyzed chemo-, regio, and enantioselective [2 + 2 + 2] cycloaddition of alkynes with isocyanates.³
4. With copper, enantioselective cross Aldol-type reaction of acetonitrile.⁴
5. With copper, enantioselective vinylsilane alkenylation of aldehydes.⁵
6. Gold carbene mediated stereoselective cyclopropanation of propargyl esters.⁶
7. With copper, enantioselective 1,2-reduction of ketones, and 1,4-reduction of α,β -unsaturated esters.⁷
8. With copper, catalytic enantioselective Mannich-type reaction.⁸
9. Enantioselective fluorination of β -keto esters, tert-butoxycarbonyl lactones and lactams with Sodeoka's Pd-aqua complex and a fluorinating reagent.⁹
10. Rh-catalyzed intramolecular olefin or carbonyl hydroacylation.¹⁰
11. Pd-catalyzed γ -arylation of β,γ -unsaturated ketones.
12. Involved in numerous conjugate alkylation, and ring-opening alkylation of azabenzonorbornadienes.¹²
13. Involved in asymmetric hydroamination of bicyclic alkenes/dienes, 1,3a diamination of conjugated dienes, 1,3b and hydroalkoxylation/hydrosulfonylation of allenes.^{13c}
14. Used in cycloaddition reactions such as 1,3-dipolar cycloaddition of azomethine ylides,^{14a} and Au-catalyzed [2+2] cycloaddition of allenes.^{14b}
15. Asymmetric conjugate addition of nitroalkanes to α,β -unsaturated thioamides.¹⁵
16. Asymmetric synthesis of isothiazoles through Cu catalyzed conjugate addition of allyl cyanide to α,β -unsaturated thioamides.¹⁶
17. Asymmetric Ag-catalyzed cycloadditions.¹⁷
18. Rhodium-catalyzed C-C bond cleavage to generate acyclic, asymmetric quaternary centers.¹⁸
19. Iridium-catalyzed intermolecular hydroamidation of olefins.¹⁹
20. Iridium-catalyzed intermolecular hydroamidation of olefins.²⁰
21. CuH-catalyzed asymmetric hydroamination of olefins.²¹



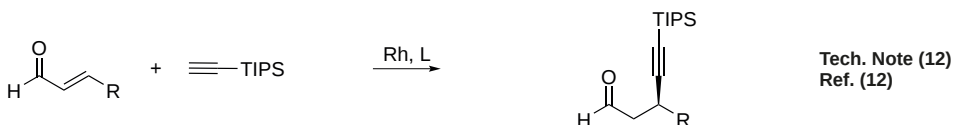
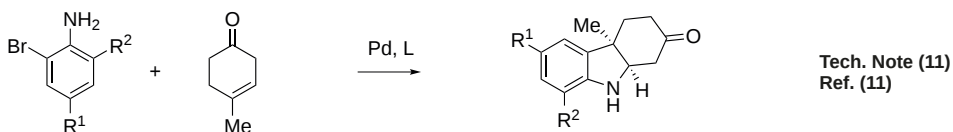
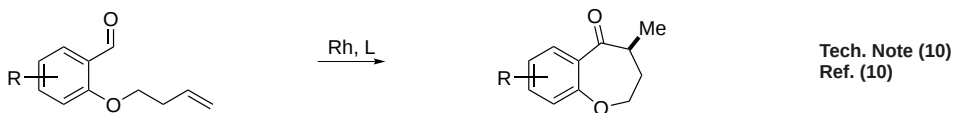
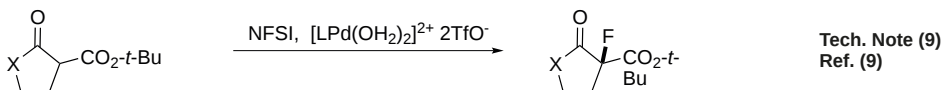
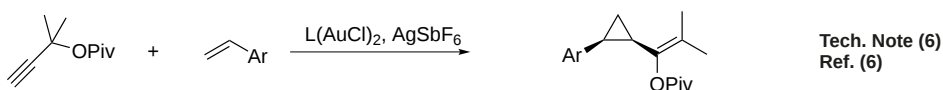
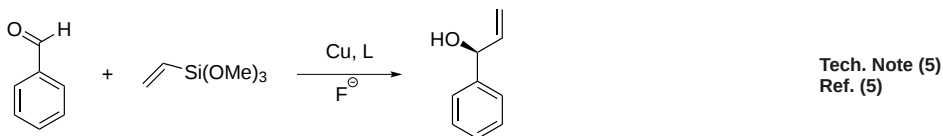
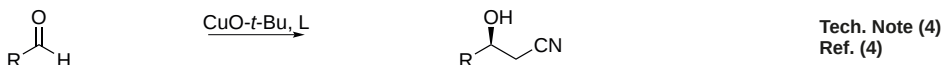
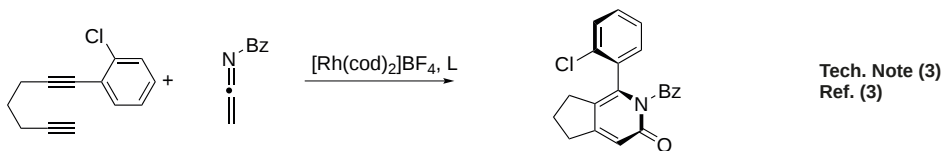
Tech. Note (1)
 Ref. (1)



Tech. Note (2)
 Ref. (2)

PHOSPHORUS - Ligands and Compounds

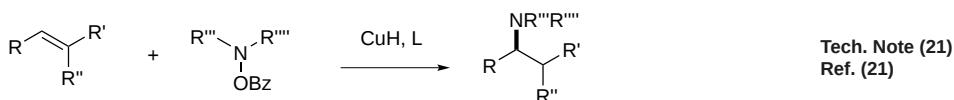
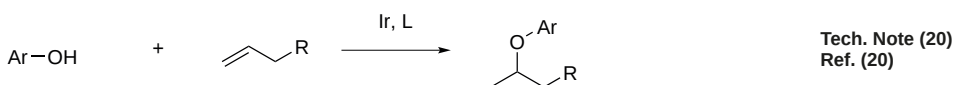
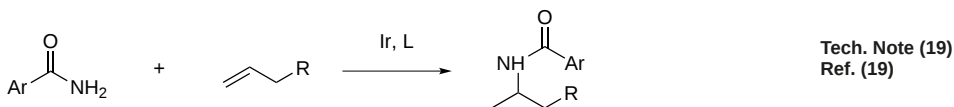
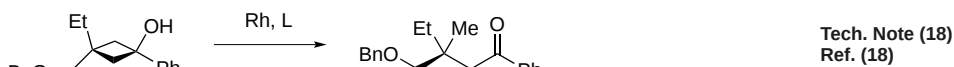
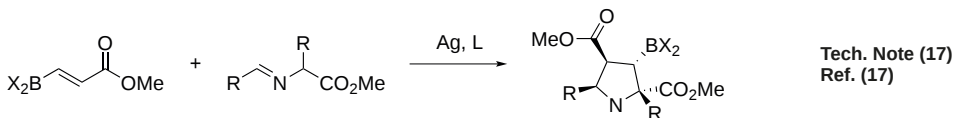
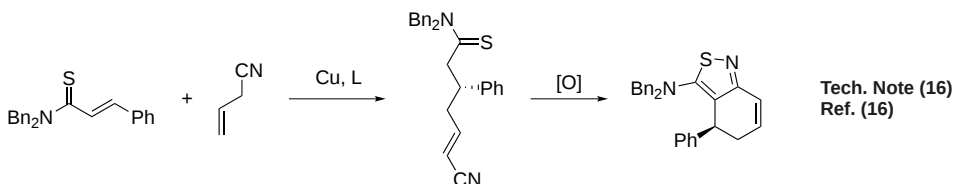
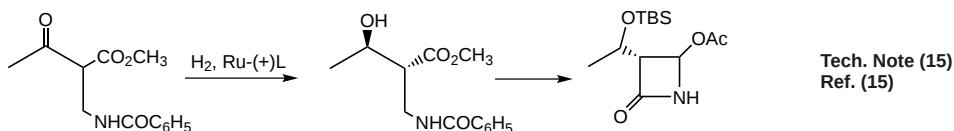
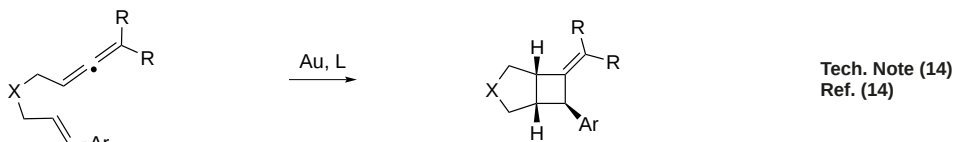
15-0066 (R)-(-)-5,5'-Bis[di(3,5-di-*t*-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole,
(continued) min. 98% (R)-(-)-DTBM-SEGPBOS® (566940-03-2)



PHOSPHORUS - Ligands and Compounds

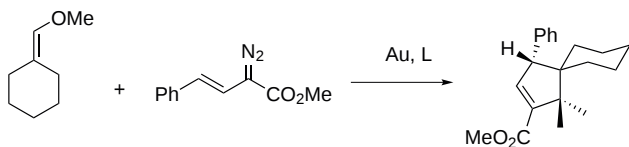
15-0066
(continued)

(R)-(-)-5,5'-Bis[di(3,5-di-*t*-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole,
min. 98% (R)-(-)-DTBM-SEGPHOS® (566940-03-2)

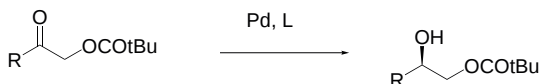


PHOSPHORUS - Ligands and Compounds

15-0066 (R)-(-)-5,5'-Bis[di(3,5-di-*t*-butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(-)-DTBM-SEGPHOS® (566940-03-2)



Tech. Note (22)
Ref. (22)



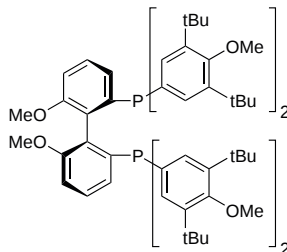
Tech. Note (23)
Ref. (23)

References:

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2. U.S. Pat. 6342644.
3. *Org. Lett.*, **2005**, 7, 4737.
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5. *J. Am. Chem. Soc.*, **2005**, 127, 4138.
6. *J. Am. Chem. Soc.*, **2005**, 127, 18002.
7. (a) *J. Am. Chem. Soc.*, **2004**, 126, 8352. (b) *Org. Lett.*, **2002**, 4, 4045.
8. *J. Am. Chem. Soc.*, **2009**, 131, 9610.
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13. (a) *J. Am. Chem. Soc.*, **2008**, 130, 12220. (b) *Org. Lett.*, **2008**, 10, 4231. (c) *Chem. Commun.*, **2009**, 3528.
14. (a) *Angew. Chem. Int. Ed.*, **2009**, 48, 340. (b) *J. Am. Chem. Soc.*, **2007**, 129, 12402.
15. *Org. Lett.*, **2012**, 14, 110.
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17. (a) *J. Org. Chem.*, **2011**, 76, 1945. (b) *J. Am. Chem. Soc.*, **2010**, 132, 3263.
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19. *J. Am. Chem. Soc.*, **2012**, 134, 11960.
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22. *J. Am. Chem. Soc.*, **2013**, 135, 13314.
23. *Angew. Chem. Int. Ed.*, **2013**, 52, 11632.

15-0067	(S)-(+)-5,5'-Bis[di(3,5-di- <i>t</i> -butyl-4-methoxyphenyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(+)-DTBM-SEGPHOS® (210169-40-7) C ₇₄ H ₁₀₀ O ₈ P ₂ ; FW: 1179.53; off-white powdr.; m.p. 126-128° Note: Manufactured under license of Takasago patent. Takasago SEGPHOS® Ligand Kit component.	250mg 1g 5g
----------------	--	-------------------

15-0042	(R)-(-)-2,2'-Bis[di(3,5-di- <i>t</i> -butyl-4-methoxyphenyl)phosphino]-6,6'-di-methoxy-1,1'-biphenyl, min. 97% (352655-61-9) C ₇₄ H ₁₀₄ O ₈ P ₂ ; FW: 1151.60; white xtl. Note: Sold in collaboration with Solvias for research purposes only. Solvias (R)-MeO BIPHEP Ligand Kit component.	100mg 500mg 2g 10g
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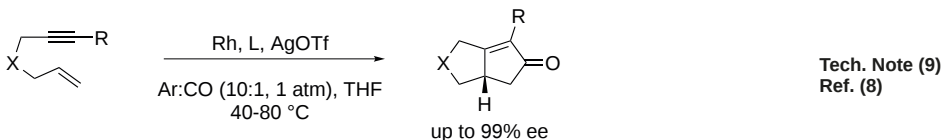
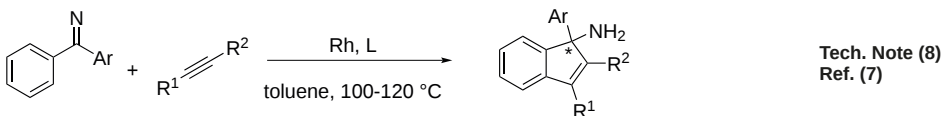
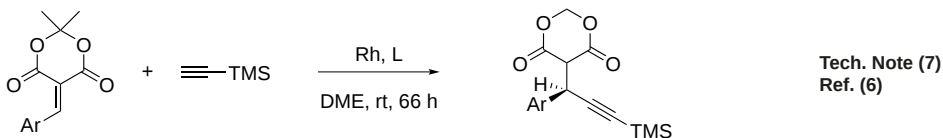
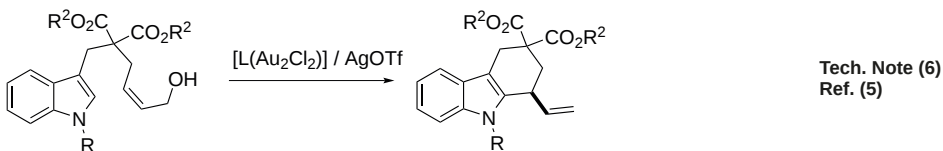
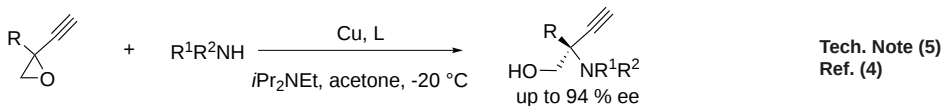
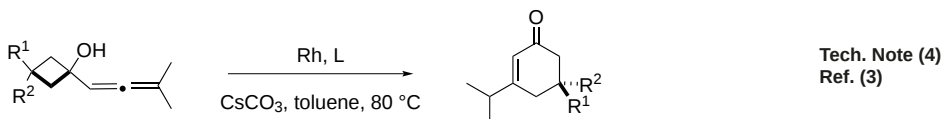
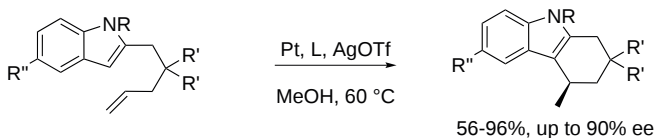
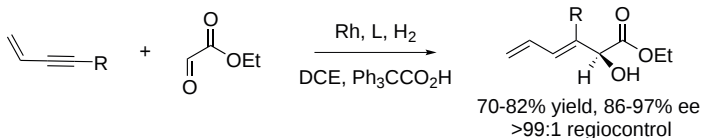
Technical Notes:

1. See 15-0178.
2. Rh-catalyzed reductive coupling of acetylene to aldehydes and ketones.
3. Pt-catalyzed intramolecular hydroarylation of unactivated alkenes with indoles.
4. Enantioselective C-C bond activation of allenyl cyclobutanes.
5. Enantioselective ring-opening of rac-ethynyl epoxides.

PHOSPHORUS - Ligands and Compounds

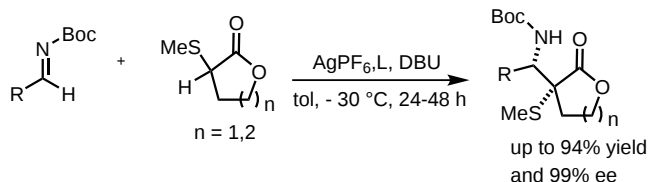
15-0042 (R)-(-)-2,2'-Bis[di(3,5-di-*t*-butyl-4-methoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, (continued) min. 97% (352655-61-9)

- Enantioselective Au-catalyzed allylic alkylation of indoles with alcohols
- Enantioselective Rh-catalyzed conjugate alkynylation with TMS-acetylene.
- Enantioselective Rh-catalyzed [3+2] annulation of aromatic ketimines.
- Asymmetric Rh-catalyzed Pausan-Khand reaction.

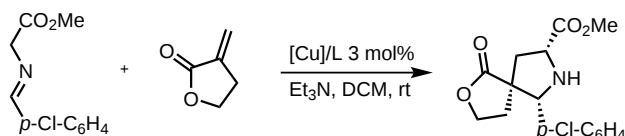


PHOSPHORUS - Ligands and Compounds

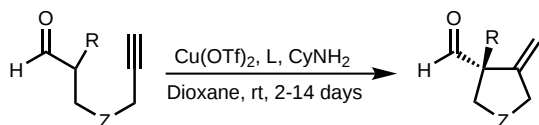
15-0042 (continued) **(R)-(-)-2,2'-Bis[di(3,5-di-*t*-butyl-4-methoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl**, min. 97% (352655-61-9)



Tech. Note (10)
Ref. (9)



Tech. Note (11)
Ref. (10)



Tech. Note (12)
Ref. (10)

References:

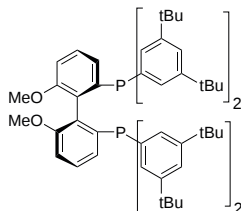
1. *Org. Lett.*, **2007**, 9, 3745.
2. *Org. Lett.*, **2006**, 8, 3801.
3. *Angew. Chem. Int. Ed.*, **2008**, 47, 9294.
4. *J. Org. Chem.*, **2009**, 74, 7603.
5. *Angew. Chem. Int. Ed.*, **2009**, 48, 9533.
6. *J. Am. Chem. Soc.*, **2009**, 131, 14608.
7. *Angew. Chem. Int. Ed.*, **2011**, 50, 11098.
8. *Adv. Synth. Catal.*, **2010**, 352, 2032.
9. *Org. Lett.*, **2013**, 15, 2632.
10. *Chem. Commun.*, **2013**, 49, 9642.
11. *Chem. Commun.*, **2012**, 48, 6559.

15-0043	(S)-(+)-2,2'-Bis[di(3,5-di-<i>t</i>-butyl-4-methoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl , min. 97% (910134-30-4)	100mg
	C ₇₄ H ₁₀₄ O ₆ P ₂ ; FW: 1151.60; white xtl.	500mg
	Note: Sold in collaboration with Solvias for research purposes only.	2g
	Solvias (S)-MeO BIPHEP Ligand Kit component.	10g

Technical Note:

1. See 15-0042 (page 29)

15-0044	(R)-(+)-2,2'-Bis[di(3,5-di-<i>t</i>-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl , min. 97% (192138-05-9)	100mg
	C ₇₀ H ₉₆ O ₆ P ₂ ; FW: 1031.49; white powdr.	500mg
	Note: Sold in collaboration with Solvias for research purposes only. Solvias (R)-MeO BIPHEP Ligand Kit component.	2g
		10g



Technical Notes:

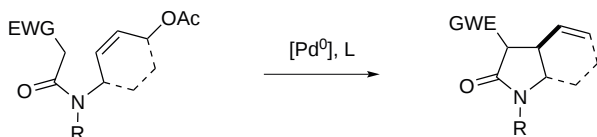
1. See 15-0178, 15-0066 and 15-0042.
2. Pd-catalyzed enantioselective Heck reaction.
3. Used in enantioselective lactam synthesis via Pd-catalyzed intramolecular allylic alkylation.
4. Used in enantioselective Au-catalyzed polycyclization reactions.



Tech. Note (2)
Ref. (1)

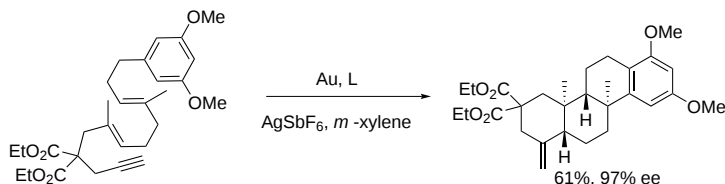
PHOSPHORUS - Ligands and Compounds

15-0044 (R)-(+)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97%
(continued) (192138-05-9)



EWG = CO₂Me, CN, COMe, SPh, SO₂Ph, R = Bn, PMB

Tech. Note (3)
Ref. (2)



Tech. Note (4)
Ref. (3)

References:

1. *Organometallics*, **1999**, 18, 670.
2. *Synlett*, **2009**, 1441.
3. *J. Am. Chem. Soc.*, **2010**, 132, 8277.

15-0045 (S)-(-)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (167709-31-1)
C₇₀H₉₆O₂P₂; FW: 1031.49; white powdr.
Note: Sold in collaboration with Solvias for research purposes only.
Solvias (S)-MeO BIPHEP Ligand Kit component.

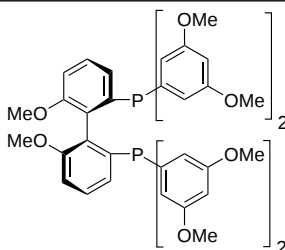
100mg
500mg
2g
10g

Technical Note:

1. See 15-0044 (page 31)

15-0185 (R)-(+)-2,2'-Bis[di(3,5-dimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, 98% (R)-ECNU-Phos (1448722-98-2)
C₄₆H₄₈O₁₀P₂; FW: 822.82; white solid; m.p. 236-237°
air sensitive, (store cold)
Note: Sold under license from ECNU for research purposes only. Patent CN201310135176.3.

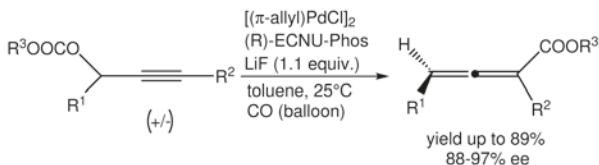
NEW



25mg
100mg

Technical Note:

1. Efficient ligand for the highly enantioselective synthesis of optically active 2,3-allenoates via carbonylation of racemic propargylic carbonates.



Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.*, **2013**, 135, 11517.

PHOSPHORUS - Ligands and Compounds

15-4320

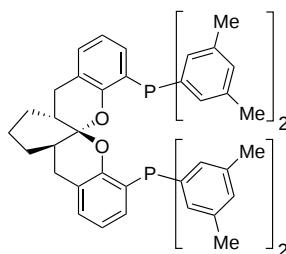
(+)-1,13-Bis[di(3,5-dimethylphenyl)phosphino]-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97%

(R,R,R)-(+)-Xyl-SKP (1429939-35-4)

$C_{52}H_{54}O_2P_2$; FW: 772.93; white solid; m.p. 102-103°

air sensitive

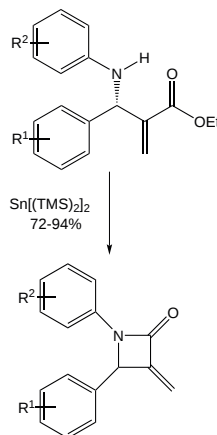
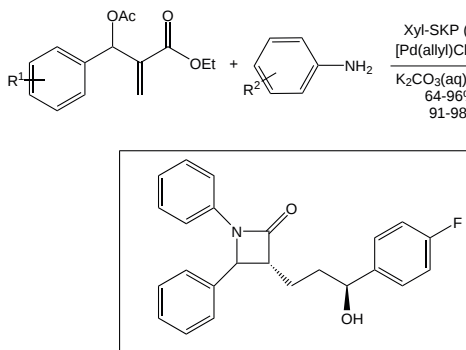
Note: Sold in collaboration with SIOC for research purposes only. Patents PCT/CN2013/071091, CN202110253896.5. SKP Ligand Kit component.



25mg
100mg

Technical Notes:

- Efficient ligand for the palladium-catalyzed, asymmetric allylic amination of racemic Morita-Baylis-Hillman adducts.
- See also 15-4311.



**Tech. Note (1)
Ref. (1,2)**

References:

- Angew. Chem. Int. Ed., **2012**, 51, 9276.
- Angew. Chem. Int. Ed., **2012**, 51, 936.

15-4321

(-)-1,13-Bis[di(3,5-dimethylphenyl)phosphino]-(5aS,8aS,14aS)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97%

(S,S,S)-(-)-Xyl-SKP (1429939-31-0)

$C_{52}H_{54}O_2P_2$; FW: 772.93; white solid; m.p. 102-103°

air sensitive

Note: Sold in collaboration with SIOC for research purposes only.

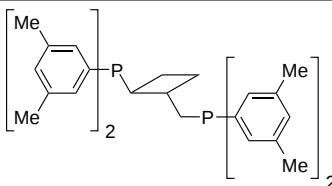
Patents PCT/CN2013/071091, CN202110253896.5. SKP Ligand Kit component.

25mg
100mg

15-5172

racemic-trans-1,2-Bis[di(3,5-dimethylphenyl)phosphinomethyl]cyclobutane, min. 95% (1226906-44-0)

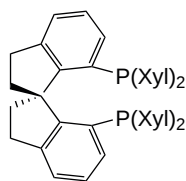
$C_{38}H_{46}P_2$; FW: 564.72; white solid



250mg
1g

PHOSPHORUS - Ligands and Compounds

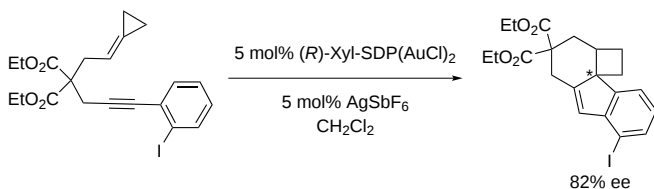
15-5168 (R)-(+)-7,7'-Bis[di(3,5-dimethylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (R)-Xyl-SDP (917377-75-4)
 $C_{49}H_{50}P_2$; FW: 700.87; off-white to pale yellow solid
air sensitive
 Note: Spiro Bisphosphine Ligand Kit component.



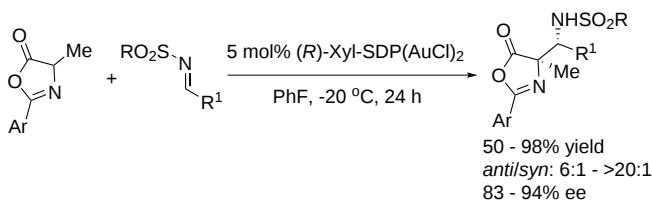
25mg
100mg

Technical Notes:

- Chiral ligands for gold-catalyzed asymmetric ring expanding cycloisomerization.
- Chiral ligands for gold-catalyzed asymmetric Mannich reactions of azlactones.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

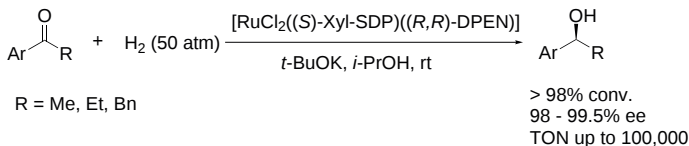
- Org. Lett.*, **2008**, *10*, 4315.
- J. Am. Chem. Soc.*, **2011**, *133*, 3517.

15-5169 (S)-(-)-7,7'-Bis[di(3,5-dimethylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (S)-Xyl-SDP (528521-89-3)
 $C_{49}H_{50}P_2$; FW: 700.87; off-white to pale yellow solid
air sensitive
 Note: Spiro Bisphosphine Ligand Kit component.

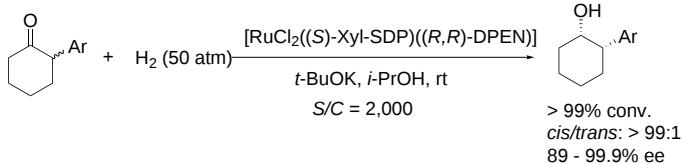
25mg
100mg

Technical Notes:

- Chiral ligands for ruthenium-catalyzed asymmetric hydrogenation of simple ketones.
- Chiral ligands for ruthenium-catalyzed asymmetric hydrogenation of racemic α -aryl cyclic ketones via dynamic kinetic resolution



Tech. Note (1)
Ref. (1)



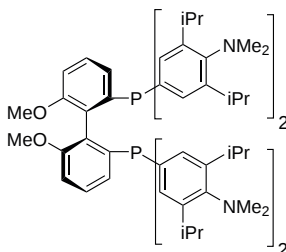
Tech. Note (2)
Ref. (2)

References:

- J. Am. Chem. Soc.*, **2003**, *125*, 4404.
- J. Org. Chem.*, **2005**, *125*, 2967.

PHOSPHORUS - Ligands and Compounds

15-0652 (R)-(-)-2,2'-Bis[di(3,5-di-*i*-propyl-4-dimethylaminophenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (352655-40-4)
 $C_{70}H_{100}N_4O_2P_2$; FW: 1091.55; white powdr.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only.
 Solvias (R)-MeO BIPHEP Ligand Kit component.

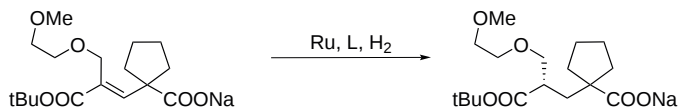


100mg
 500mg
 2g
 10g

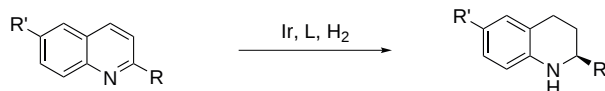
In many respects the catalytic profile of the MeOBIPHEP ligands is similar to that of other atropisomeric diphosphines such as binap and its many analogs. The nature of the PR₂ group strongly influences the catalytic performance of the metal complexes. The rhodium and ruthenium MeO-BIPHEP catalysts are highly effective for the hydrogenation of various C=O, C=C and C=N bonds and several synthetically useful C-C coupling reactions.

Technical Notes:

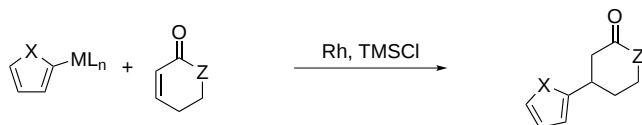
1. See 15-0042
2. Ru and Ir catalyzed dynamic kinetic resolution for the synthesis of hydroxy, amino acid derivatives.
3. Ru-catalyzed asymmetric hydrogenation of ketones and alkenes.
4. Ir catalyzed enantioselective hydrogenation of heteroaromatic compounds.
5. Conjugate addition using 2-heteroaryl titanates and zinc reagents.
6. Conjugate addition of terminal alkynes to α,β -unsaturated thioamides.



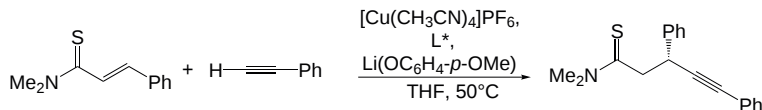
Tech. Note (3)
 Ref. (3)



Tech. Note (4)
 Ref. (4)



Tech. Note (5)
 Ref. (5)



Tech. Note (6)
 Ref. (6,7)

References:

1. *Adv. Synth. Catal.*, **2004**, 346, 842.
2. *Org. Lett.*, **2006**, 8, 4573.
3. *Org. Process Res. Dev.*, **2001**, 5, 438.
4. *J. Am. Chem. Soc.*, **2003**, 125, 10536.
5. *Org. Lett.*, **2009**, 11, 4200.
6. *Chem. Asian J.*, **2011**, 6, 1778.
7. *J. Am. Chem. Soc.*, **2010**, 132, 10275.

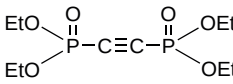
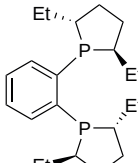
15-0653 (S)-(+)-2,2'-Bis[di(3,5-di-*i*-propyl-4-dimethylaminophenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (919338-66-2)
 $C_{70}H_{100}N_4O_2P_2$; FW: 1091.55; white powdr.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only. Solvias (S)-MeO BIPHEP Ligand Kit component.

100mg
 500mg
 2g
 10g

Technical Note:

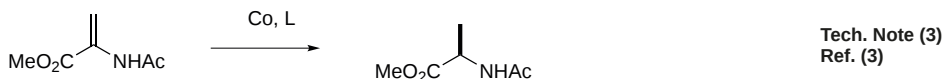
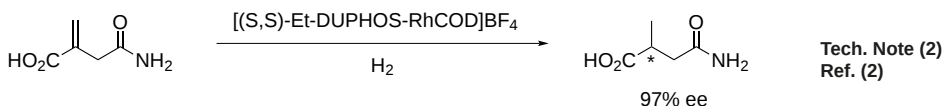
1. See 15-0652 (page 35)

PHOSPHORUS - Ligands and Compounds

15-0119	Bis(diethoxyphosphoryl)acetylene, 99% (4851-53-0) $C_{10}H_{20}O_6P_2$; FW: 298.21; yellow liq.; b.p. 181.5-182.5(2.5mm); d. 1.12 <i>moisture sensitive</i>		500mg 2g
15-0084 amp HAZ	Bis(diethylamino)chlorophosphine, min. 97% (685-83-6) [(C_2H_5) ₂ N] ₂ PCl; FW: 210.68; colorless to light yellow liq. (may contain trace insolubles); b.p. 124-125°/15 mm; d. 1.002 <i>air sensitive, moisture sensitive</i>		1g 5g
15-0083 amp HAZ	1,2-Bis(diethylphosphino)ethane, 98% (6411-21-8) (C_8H_{18}) ₂ PCH ₂ CH ₂ P(C_2H_5) ₂ ; FW: 206.25; colorless liq.; b.p. 124-126°/10 mm; d. 0.884 (25°) <i>air sensitive</i>		1g 5g
15-0097	(-)-1,2-Bis((2R,5R)-2,5-diethylphospholano)benzene, 98+% ((R,R)-Et-DUPHOS (136705-64-1) $C_{22}H_{36}P_2$; FW: 362.48; colorless oil; d. 1.01 <i>air sensitive</i>		100mg 500mg 2g

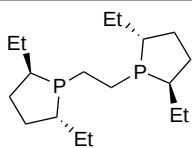
Technical Notes:

- See 15-0096.
- Ligand used in rhodium catalyzed asymmetric hydrogenation of 2-methylenesuccinamic acid.
- Cobalt-catalyzed asymmetric hydrogenation.



References:

- Encyclopedia of Reagents for Organic Synthesis, **1995**, Vol. 1, 489
- Org. Proc. Res. Dev., **2003**, 7, 407.
- Science., **2013**, 342, 1076.

15-0098	(+)-1,2-Bis((2S,5S)-2,5-diethylphospholano)benzene, 98+% (S,S)-Et-DUPHOS (136779-28-7) $C_{22}H_{36}P_2$; FW: 362.48; colorless oil; d. 1.010 <i>air sensitive</i>		100mg 500mg 2g
15-0101	(+)-1,2-Bis((2R,5R)-2,5-diethylphospholano)ethane, 98+% (R,R)-Et-BPE (136705-62-9) (C_8H_{16}) ₂ PCH ₂ CH ₂ P(C_2H_5) ₂ ; FW: 314.43; colorless to pale-yellow liq.; b.p. 104-106°/0.05mm; d. 0.939 <i>air sensitive</i>		100mg 500mg 2g

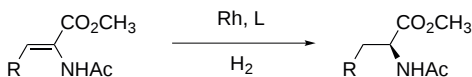
Technical Notes:

- The DUPHOS family of catalysts is highly efficient for the asymmetric hydrogenation of various substituted acetamidoacrylates and enol acetates yielding products of high enantiomeric excesses.¹ Efficient ligand for the asymmetric hydrogenation of tetrasubstituted enamides.²
- Asymmetric hydrogenation of vinyl alcohols.²
- Catalyst used for the asymmetric hydrogenation of enol phosphonates.⁴
- Asymmetric hydrogenation of allylic alcohols.⁵
- Ligand for the catalytic asymmetric [4+1] cycloaddition of vinylallenes with CO.⁵
- Ligand for the Rh-catalyzed asymmetric enyne cycloisomerization.⁶

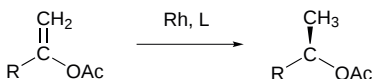
PHOSPHORUS - Ligands and Compounds

15-0101 (+)-1,2-Bis((2R,5R)-2,5-diethylphospholano)ethane, 98+% (R,R)-Et-BPE (136705-62-9)
(continued)

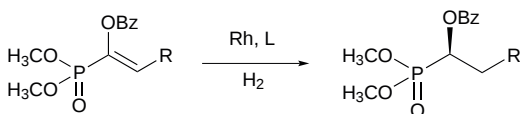
7. Catalytic enantioselective addition of dialkylzinc to N-Diphenylphosphinoylimines.⁸
8. Palladium catalyzed asymmetric phosphination.⁹
10. Palladium-catalyzed 1,4 arylation of α , β -unsaturated ketones.¹¹
11. Asymmetric, Ir-catalyzed, [2+2+2] cycloaddition.¹²
12. Asymmetric palladium-catalyzed synthesis of 2-methyl-indolines via C-H activation.¹³
13. Copper-catalyzed monoborylation of 1,3-Dienes.¹⁴
14. Rhodium-catalyzed enantioselective transmetalation.¹⁵
15. CuH-catalyzed hydroamination of styrenes.¹⁶



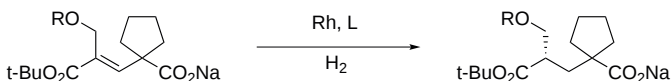
Tech. Note (1)
Ref. (2)



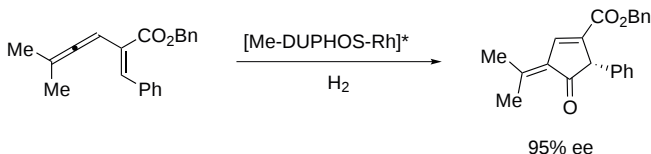
Tech. Note (2)
Ref. (3)



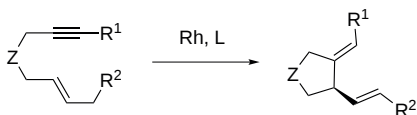
Tech. Note (3)
Ref. (4)



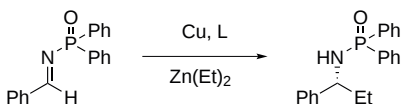
Tech. Note (4)
Ref. (5)



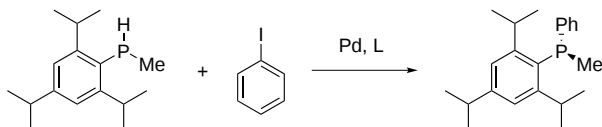
Tech. Note (5)
Ref. (6)



Tech. Note (6)
Ref. (7)



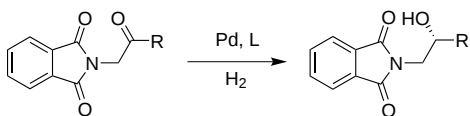
Tech. Note (7)
Ref. (8)



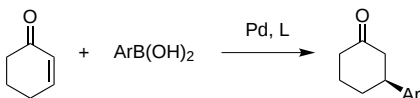
Tech. Note (8)
Ref. (9)

PHOSPHORUS - Ligands and Compounds

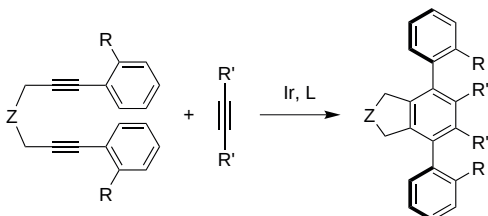
15-0101 (+)-1,2-Bis((2R,5R)-2,5-diethylphospholano)ethane, 98+% (R,R)-Et-BPE (136705-62-9)
(continued)



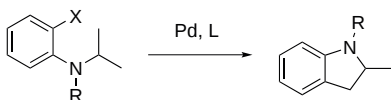
Tech. Note (9)
Ref. (10)



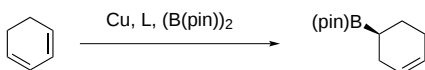
Tech. Note (10)
Ref. (11)



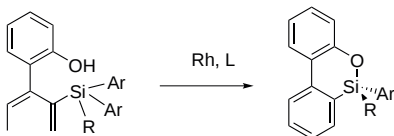
Tech. Note (11)
Ref. (12)



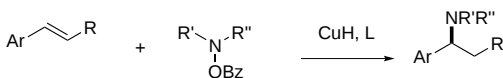
Tech. Note (12)
Ref. (13)



Tech. Note (13)
Ref. (14)



Tech. Note (14)
Ref. (15)



Tech. Note (15)
Ref. (16)

References:

- (a) Burk, M.J., *Handbook of Chiral Chemicals*, Abel, Ager, D.J., Ed. (Marcel Dekker, Inc., New York, 1999) Ch 18, p 339. (review). (b) *Acc. Chem. Res.*, **2000**, 33, 363. (review)
- (a) *J. Am. Chem. Soc.*, **1993**, 115, 10125. (b) *J. Am. Chem. Soc.*, **1992**, 114, 6266. (c) *J. Am. Chem. Soc.*, **1996**, 118, 5142. (d) *Tetrahedron Lett.*, **1999**, 40, 6685. (e) *J. Am. Chem. Soc.*, **1995**, 117, 9375.
- J. Am. Chem. Soc.*, **1991**, 113, 8518.
- Org. Lett.*, **1999**, 1, 387.
- J. Org. Chem.*, **1999**, 64, 3290.
- J. Am. Chem. Soc.*, **1999**, 121, 4130.
- Angew. Chem. Int. Ed.*, **2000**, 39, 4104.
- J. Am. Chem. Soc.*, **2003**, 125, 1692.
- J. Am. Chem. Soc.*, **2002**, 124, 13356.
- Org. Lett.*, **2005**, 7, 3235.
- Org. Lett.*, **2005**, 7, 5309.
- J. Am. Chem. Soc.*, **2004**, 126, 8382.
- Chem. Commun.*, **2011**, 47, 11483.
- J. Am. Chem. Soc.*, **2010**, 132, 1226.
- J. Am. Chem. Soc.*, **2012**, 134, 16955.
- Angew. Chem. Int. Ed.*, **2013**, 52, 10830.

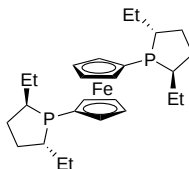
PHOSPHORUS - Ligands and Compounds

15-0102	(-)-1,2-Bis((2S,5S)-2,5-diethylphospholano)ethane, 98+% (S,S)-Et-BPE (136779-27-6) (C ₈ H ₁₆)PCH ₂ CH ₂ P(C ₈ H ₁₆); FW: 314.43; colorless to pale-yellow liq.; b.p. 104-106°/0.05mm <i>air sensitive</i>	100mg 500mg 2g
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Technical Note:

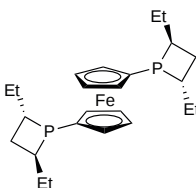
- See 15-0101 (page 36)

26-1625	1,1'-Bis[(2R,5R)-2,5-diethylphospholano]ferrocene, min. 97% (147762-89-8) C ₂₆ H ₄₀ FeP ₂ ; FW: 470.39; yellow solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	250mg 1g
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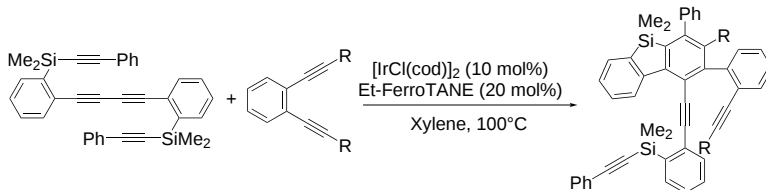
26-1626	1,1'-Bis[(2S,5S)-2,5-diethylphospholano]ferrocene, min. 97% (436863-50-2) C ₂₆ H ₄₀ FeP ₂ ; FW: 470.39; yellow solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	250mg 1g
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26-0201	(-)-1,1'-Bis[(2S,4S)-2,4-diethylphosphonato]ferrocene, min. 95% (S,S)-Et-FerroTANE® (290347-66-9) [C ₉ H ₁₄ (C ₇ H ₁₄ P)] ₂ Fe; FW: 442.35; yellow-orange powdr.; m.p. 76° <i>air sensitive</i> Note: **Limited quantities available** Sold in collaboration with Chirotech for research purposes only. US Patent no. 5936109.	100mg
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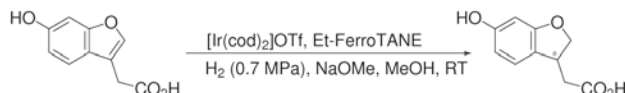


Technical Notes:

- Ligand for Ir-catalyzed [2+2+2] cycloaddition for enantioselective synthesis of silahelicenes.
- Ligand for the preparation of (2,3-dihydrobenzofuran-3-yl)-acetic acid derivatives via Rh-catalyzed asymmetric hydrogenation.



Tech. Note (1)
Ref. (1)



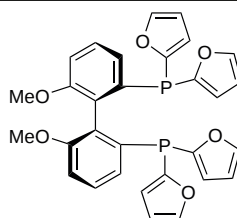
Tech. Note (2)
Ref. (2)

References:

- Chem. Commun., **2012**, 48, 1311.
- Bull. Chem. Soc. Jpn., **2014**, 87, 539.

PHOSPHORUS - Ligands and Compounds

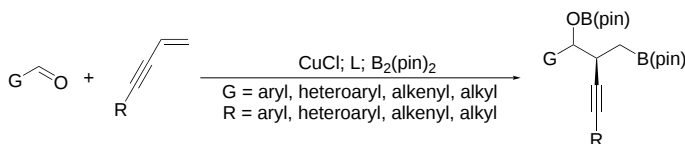
15-0112 (R)-(-)-2,2'-Bis(di-2-furanylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (145214-57-9)
 $C_{30}H_{24}O_8P_2$; FW: 542.47; off-white powdr.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only. Solvias
 (R)-MeO BIPHEP Ligand Kit component.



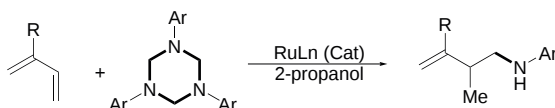
100mg
 500mg
 2g
 10g

Technical Notes:

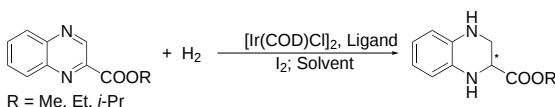
1. Ligand for the copper-catalyzed diastereo- and enantioselective reactions of bis(pinacolato)diboron, 1,3-enynes and aldehydes.
2. Ligand for ruthenium-catalyzed enantioselective hydroaminomethylation of dienes and isoprene with 1,3,5-tris(aryl)-hexahydro-1,3,5-triazines.
3. Ligand for iridium-catalyzed asymmetric hydrogenation of quinoxaline-2-carboxylates.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

1. *J. Am. Chem. Soc.*, **2014**, 136, 11304.
2. *Chem. Sci.*, **2016**, 7, 136.
3. *Tetrahedron*, **2016**, 72, 1375.

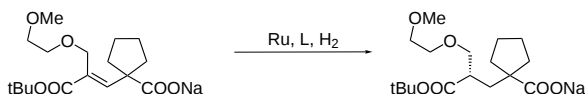
15-0113 (S)-(-)-2,2'-Bis(di-2-furanylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (145214-59-1)
 $C_{30}H_{24}O_8P_2$; FW: 542.47; off-white powdr.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only.
 Solvias (S)-MeO BIPHEP Ligand Kit component.

100mg
 500mg
 2g
 10g

In many respects the catalytic profile of the MeOBIPHEP ligands is similar to that of other atropisomeric diphosphines such as binap and its many analogs. The nature of the PR₂ group strongly influences the catalytic performance of the metal complexes. The rhodium and ruthenium MeO-BIPHEP catalysts are highly effective for the hydrogenation of various C=O, C=C and C=N bonds and several synthetically useful C-C coupling reactions.

Technical Notes:

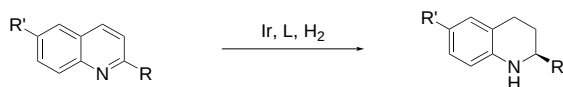
1. See 15-0042.
2. Ru and Ir catalyzed dynamic kinetic resolution for the synthesis of hydroxy, amino acid derivatives.
3. Ru-catalyzed asymmetric hydrogenation of ketones and alkenes.
4. Ir catalyzed enantioselective hydrogenation of heteroaromatic compounds.
5. Conjugate addition using 2-heteroaryl titanates and zinc reagents.
6. Pd-catalyzed asymmetric allylation reactions.



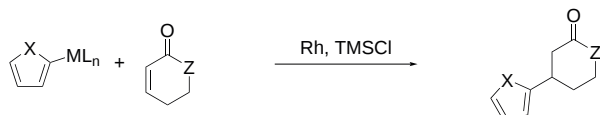
Tech. Note (3)
Ref. (3)

PHOSPHORUS - Ligands and Compounds

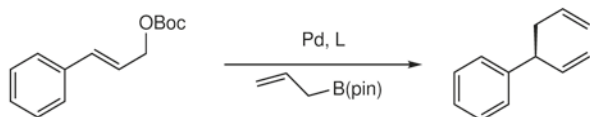
15-0113 (S)-(-)-2,2'-Bis(di-2-furanylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%
(continued) (145214-59-1)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)

References:

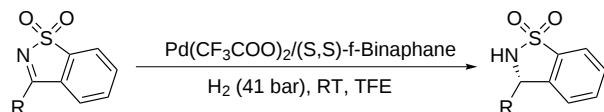
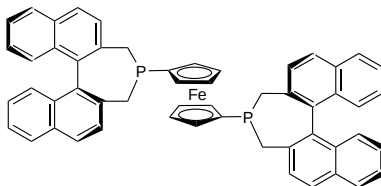
1. *Adv. Synth. Catal.*, **2004**, 346, 842.
2. *Org. Lett.*, **2006**, 8, 4573.
3. *Org. Process Res. Devel.*, **2001**, 5, 438.
4. *J. Am. Chem. Soc.*, **2003**, 125, 10536.
5. *Org. Lett.*, **2009**, 11, 4200.
6. (a) *J. Am. Chem. Soc.*, **2010**, 132, 10686.
(b) *J. Am. Chem. Soc.*, **2011**, 133, 9716.
(c) *J. Am. Chem. Soc.*, **2011**, 133, 16778.

26-0243 **1,1'-Bis((S)-4,5-dihydro-3H-binaphtho[1,2-c:2',1'-e]phosphino)ferrocene, min. 98% (S,S)-f-Binaphane (544461-38-3)**
C₅₄H₄₀FeP₂; FW: 806.69; yellow-brown powdr.
air sensitive, light sensitive
Note: Sold in collaboration with Chiral Quest for research purposes only.
US Patent No. 6,525,210, US6828271.

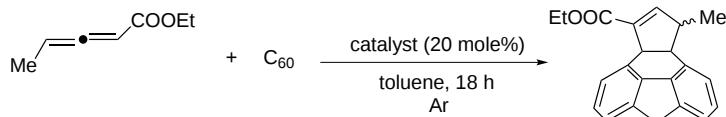
100mg
500mg

Technical Notes:

1. Ligand for enantioselective Pd-catalyzed hydrogenation of enesulfonamides [5] and cyclic N-sulfonylimines^[6]
2. Enantioselective, asymmetric organocatalyst for [3+2] cycloaddition of allenates to C60 fullerene (conversion >90%; ee up to 90%)
3. Ligand for Iridium-mediated direct asymmetric reductive amination of acetophenone with phenylhydrazide (conversion >99%; yield >94%; ee >94%)
4. Ligand used for the palladium-catalyzed, asymmetric, decarboxylative generation and asymmetric allylation of α-imino anions.
5. Ligand used in iridium-catalyzed, asymmetric hydrogenation of 6-substituted 3-hydroxypyridinium salts to trans 6-substituted piperidin-3-ols with high enantioselectivities (up to 95% ee).



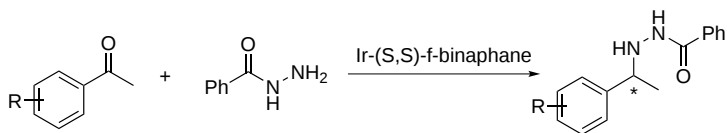
Tech. Note (1)
Ref. (1)



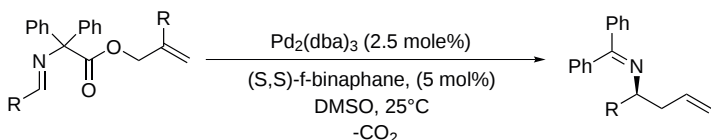
Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

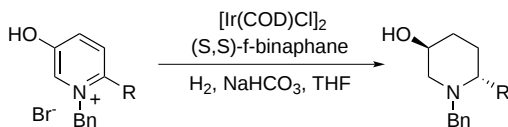
26-0243 1,1'-Bis((S)-4,5-dihydro-3H-binaphtho[1,2-c:2',1'-e]phosphino)ferrocene, min. 98%
(continued) (S,S)-f-Binaphane (544461-38-3)



Tech. Note (3)
Ref. (3)



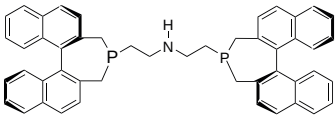
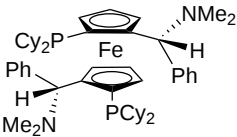
Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

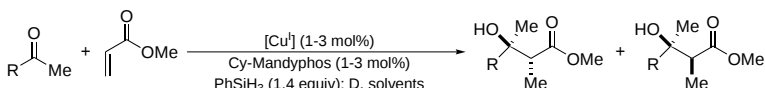
References:

1. *J. Org. Chem.*, **2009**, 74, 5633.
2. *Angew. Chem. Int. Ed.*, **2013**, 53, 5115.
3. *Org. Lett.*, **2013**, 15, 4354.
4. *Org. Lett.*, **2014**, 16, 5228.
5. *ACS Catal.*, **2016**, 6, 2368.

15-7301	Bis[2-[(11bR)-3,5-dihydro- 4H-dinaphtho[2,1-c:1',2'-e]phosphepin-4-ylethyl]amine, min. 97% (851870-89-8) $\text{C}_{48}\text{H}_{41}\text{NP}_2$; FW: 693.79; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO2004096735.		100mg 500mg
15-0089	1,2-Bis(dimethoxyphosphoryl)benzene, 99% (15104-46-8) $\text{C}_6\text{H}_4[\text{P}(\text{O})(\text{OCH}_3)_2]_2$; FW: 294.18; white xtl.; m.p. 80-82°		5g 25g
26-0240	(S,S)-(+)-2,2'-Bis[(R)-(N,N-dimethyl-amino)(phenyl)methyl]-1,1'-bis(dicyclohexylphosphino)ferrocene, min. 97% (494227-35-9) $\text{C}_{52}\text{H}_{74}\text{FeN}_2\text{P}_2$; FW: 844.95; orange-red solid (store cold) Note: Sold in collaboration with Solvias for research purposes only. Solvias MandyPhos™ Ligand Kit component.		100mg 500mg 2g 10g

Technical Notes:

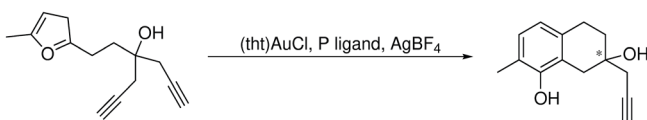
1. Ligand for a copper-catalyzed domino conjugated reduction/aldol reaction of methyl acrylate with various alkyl aryl ketones.
2. Ligand for gold catalyzed Phenol synthesis from furyldialkyne
3. Ligand for asymmetric palladium-catalyzed cross-coupling of aryl triflates with $[(\eta^6\text{-benzylamine})\text{Cr}(\text{CO})_3]$



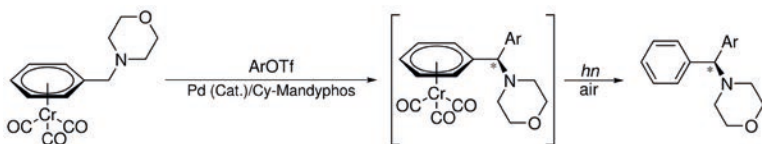
Tech. Note (1)

PHOSPHORUS - Ligands and Compounds

26-0240 (S,S)-(+)-2,2'-Bis[(R)-(N,N-dimethyl-amino)(phenyl)methyl]-1,1'-bis(dicyclohexylphosphino)ferrocene, min. 97% (494227-35-9)



Tech. Note (2)



Tech. Note (3)

Ar=4-CH₃C₆H₄ 91% yield, 86% ee

Ar=4-tBuC₆H₄ 76% yield, 88% ee

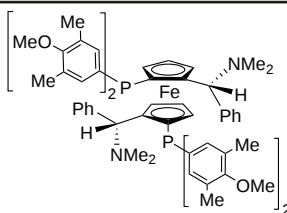
Ar=4-MeOC₆H₄ 63% yield, 85% ee

Ar=3-CH₃C₆H₄ 87% yield, 91% ee

References:

1. *Angew. Chem. Int. Ed.*, **2006**, 45, 1292.
2. *Chem. Eur. J.*, **2009**, 15, 13318.
3. *Angew. Chem. Int. Ed.*, **2012**, 51, 11510.

26-0248 (S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis[di(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocene, min. 97% (494227-37-1)
C₆₄H₇₄FeN₂O₄P₂; FW: 1053.08;
yellow to orange-red solid
(store cold)
Note: Sold in collaboration with Solvias for research purposes only.
Solvias MandyPhos™ Ligand Kit component.



100mg

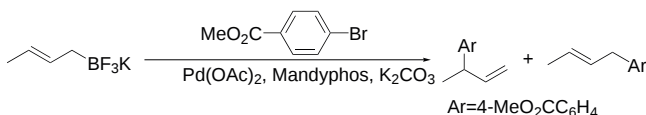
500mg

2g

10g

Technical Note:

1. Ligand for palladium catalyzed asymmetric coupling of potassium crotyltrifluoroborate with methyl 4-Bromobenzoate



Tech. Note (1)

Ref. (2)

References:

1. *Organometallics*, **2009**, 28, 152.

26-0245 (R,R)-(+)-2,2'-Bis[(S)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(di(3,5-dimethylphenyl)phosphino)ferrocene, min. 97% (847997-73-3)
C₆₀H₆₆FeN₂P₂; FW: 932.99; orange powdr.
(store cold)
Note: Sold in collaboration with Solvias for research purposes only.

100mg

500mg

2g

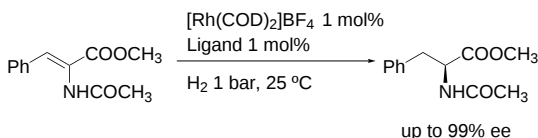
10g

Technical Notes:

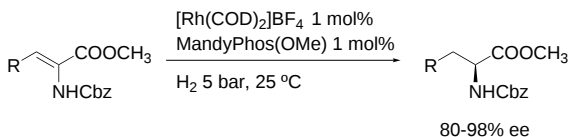
1. Ligand for Rh-catalyzed asymmetric hydrogenation of α-acetamidoacrylates.
2. Ligand for Rh-catalyzed hydrogenation of α- and α-enamides, acrylic acid derivatives, itaconates, α-ketoesters and 1,3-diketones.
3. Ligand for Rh-catalyzed asymmetric hydrogenation of furyl-substituted (Z)-dehydroamino acid derivatives.
4. Ligand for Ir-catalyzed asymmetric transfer hydrogenation of ketones.
5. Ligand for Cu-catalyzed enantioselective hydroboration of α- and α-unsaturated esters and nitriles.

PHOSPHORUS - Ligands and Compounds

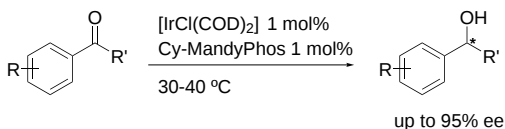
26-0245 (R,R)-(+)-2,2'-Bis[(S)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(di(3,5-dimethylphenyl)phosphino)ferrocene, min. 97% (847997-73-3)



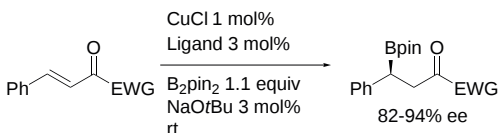
Tech. Note (1)
Ref. (2)



Tech. Note (3)
Ref. (4)



Tech. Note (4)
Ref. (5)



Tech. Note (5)
Ref. (6)

References:

1. *Chem. Eur. J.*, **1998**, 4, 950.
2. *Tetrahedron-Asymmetry*, **1999**, 10, 375.
3. *Tetrahedron-Asymmetry*, **2004**, 15, 2299.
4. *Chem. Eur. J.*, **2006**, 12, 5376.
5. *Chem. Eur. J.*, **2008**, 14, 10388.
6. *Angew. Chem. Int. Ed.*, **2008**, 47, 145.

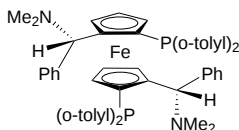
26-0246 (S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(di(3,5-dimethylphenyl)phosphino)ferrocene, min. 97% (793718-16-8)
 $C_{60}H_{66}FeN_2P_2$; FW: 932.99; orange powder.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only. Solvias MandyPhos™ Ligand Kit component.

100mg
500mg
2g
10g

Technical Note:

1. See 26-0245 (page 43)

26-0253 (R,R)-(+)-2,2'-Bis[(S)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(di(2-methylphenyl)phosphino)ferrocene, min. 97% (831226-39-2)
 $C_{58}H_{58}FeN_2P_2$; FW: 876.88; orange powder.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only.

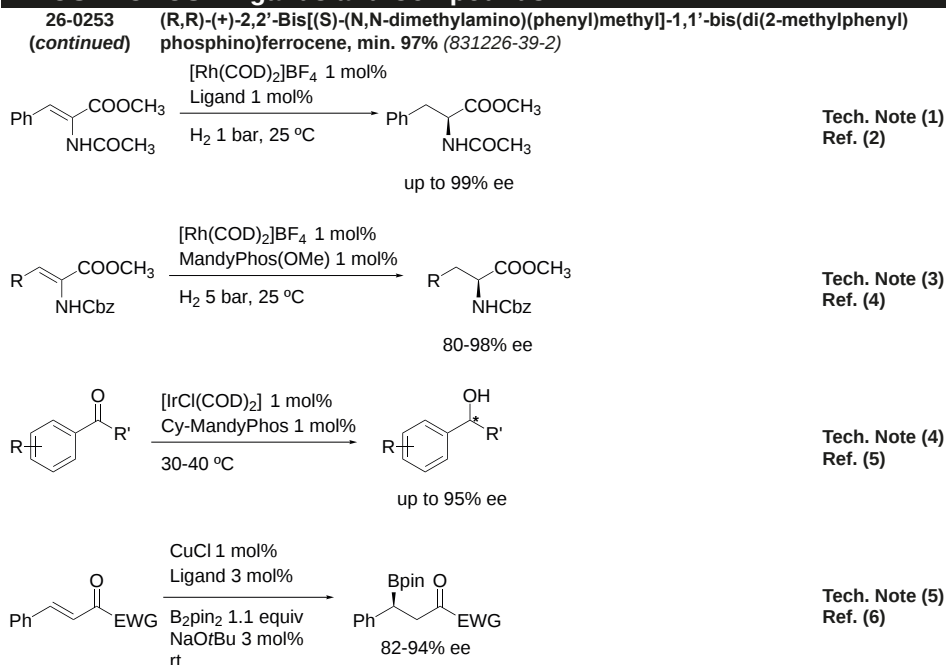


100mg
500mg

Technical Notes:

1. Ligand for Rh-catalyzed asymmetric hydrogenation of α -acetamidoacrylates.
2. Ligand for Rh-catalyzed hydrogenation of α - and α -enamides, acrylic acid derivatives, itaconates, α -ketoesters and 1,3-diketones.
3. Ligand for Rh-catalyzed asymmetric hydrogenation of furyl-substituted (Z)-dehydroamino acid derivatives.
4. Ligand for Ir-catalyzed asymmetric transfer hydrogenation of ketones.
5. Ligand for Cu-catalyzed enantioselective hydroboration of α - and α -unsaturated esters and nitriles.

PHOSPHORUS - Ligands and Compounds



References:

1. *Chem. Eur. J.*, **1998**, 4, 950.
2. *Tetrahedron-Asymmetr.*, **1999**, 10, 375.
3. *Tetrahedron-Asymmetr.*, **2004**, 15, 2299.
4. *Chem. Eur. J.*, **2006**, 12, 5376.
5. *Chem. Eur. J.*, **2008**, 14, 10388.
6. *Angew. Chem. Int. Ed.*, **2008**, 47, 145.

26-0252 (S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis(diphenylphosphino)ferrocene, min. 97% (174467-31-3)

C₅₂H₅₀FeN₂P₂; FW: 820.76;

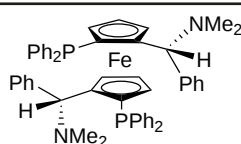
orange-red solid

(store cold)

Note: Sold in collaboration with Solvias

for research purposes only. Solvias

MandyPhos™ Ligand Kit component.



100mg

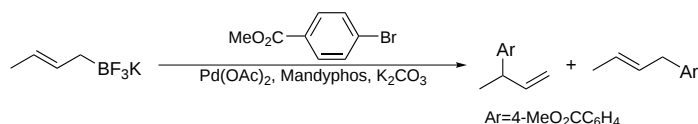
500mg

2g

10g

Technical Notes:

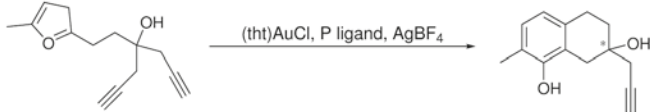
1. Ligand used for the palladium-catalyzed asymmetric coupling of potassium crotyltrifluoroborate with methyl 4-bromobenzoate.
2. Ligand used for the gold-catalyzed phenol synthesis from furyldialkyne.
3. Ligand for asymmetric palladium-catalyzed cross-coupling of aryl triflates with [(h6-benzylamine)Cr(CO)₃].
4. Ligand used for the palladium-catalyzed asymmetric synthesis of α-allyl-α-aryl α-amino acids by tandem alkylation/π-allylation of α-iminoesters



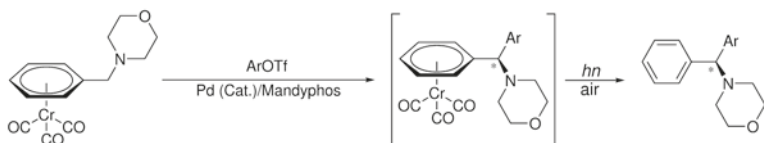
Tech. Note (1)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

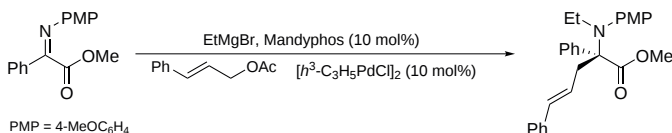
26-0252 (S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl) methyl]-1,1'-bis(diphenylphosphino) ferrocene, min. 97% (174467-31-3)



Tech. Note (3)
Ref. (4)



Tech. Note (4)
Ref. (5)



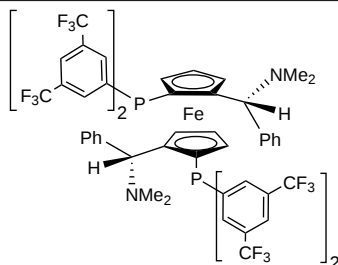
Tech. Note (5)
Ref. (6)

PMP = 4-MeOC₆H₄

References:

1. *Organometallics.*, **2009**, 28, 152.
2. *Chem. Eur. J.*, **2009**, 15, 13318.
3. *Angew. Chem. Int. Ed.*, **2012**, 51, 11510.
4. *Org. Lett.*, **2014**, 16, 1948.

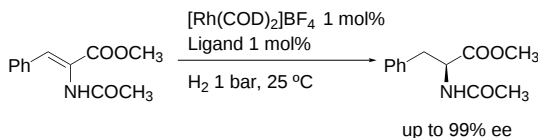
26-0244 (S,S)-(-)-2,2'-Bis[(R)-(N,N-dimethylamino)(phenyl)methyl]-1,1'-bis[di(3,5-trifluoromethylphenyl)phosphino]ferrocene, min. 97% (494227-36-0)
C₆₀H₄₂F₂₄FeN₂P₂; FW: 1364.74; orange-red solid (store cold)
Note: Sold in collaboration with Solvias for research purposes only.
Solvias MandyPhos™ Ligand Kit component.



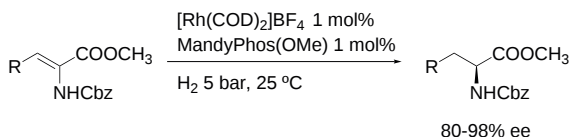
100mg
500mg
2g
10g

Technical Notes:

1. Ligand for Rh-catalyzed asymmetric hydrogenation of α-acetamidoacrylates.
2. Ligand for Rh-catalyzed hydrogenation of α- and α-enamides, acrylic acid derivatives, itaconates, α-ketoesters and 1,3-diketones.
3. Ligand for Rh-catalyzed asymmetric hydrogenation of furyl-substituted (Z)-dehydroamino acid derivatives.
4. Ligand for Ir-catalyzed asymmetric transfer hydrogenation of ketones.
5. Ligand for Cu-catalyzed enantioselective hydroboration of α- and α-unsaturated esters and nitriles.



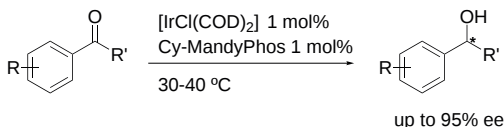
Tech. Note (1)
Ref. (2)



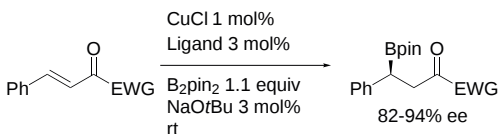
Tech. Note (3)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

26-0244 (continued) (S,S)-(-)-2,2'-Bis[(R)-N,N-dimethylamino(phenyl)methyl]-1,1'-bis[di(3,5-trifluoromethyl-phenyl)phosphino]ferrocene, min. 97% (494227-36-0)



Tech. Note (4)
Ref. (5)

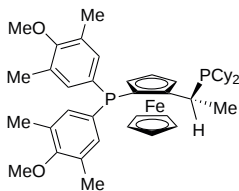


Tech. Note (5)
Ref. (6)

References:

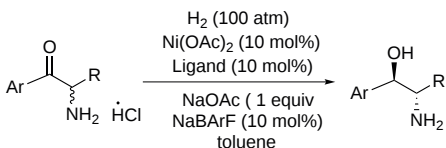
1. *Chem. Eur. J.*, **1998**, *4*, 950.
2. *Tetrahedron-Asymmetr.*, **1999**, *10*, 375.
3. *Tetrahedron-Asymmetr.*, **2004**, *15*, 2299.
4. *Chem. Eur. J.*, **2006**, *12*, 5376.
5. *Chem. Eur. J.*, **2008**, *14*, 10388.
6. *Angew. Chem. Int. Ed.*, **2008**, *47*, 145.

15-0087 HAZ	Bis(dimethylamino)phosphoryl chloride, 95+% (1605-65-8) [(CH ₃) ₂ N] ₂ P(O)Cl; FW: 170.58; colorless liq.; b.p. 85°/0.35 mm; f.p. >230°F; d. 1.17 <i>moisture sensitive</i>	10g 50g
15-0111 HAZ	Bis(3,5-dimethyl-4-methoxyphenyl)chlorophosphine, min. 98% (136802-85-2) C ₁₈ H ₂₂ ClO ₂ P; FW: 336.79; colorless, viscous liq. <i>moisture sensitive</i>	500mg 2g
26-1150	(R)-(-)-1-[(S)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl]ethylidicyclohexylphosphine, min. 97% (360048-63-1) C ₄₂ H ₅₆ FeO ₂ P ₂ ; FW: 710.71; orange powdr. Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.	100mg 500mg 2g 10g

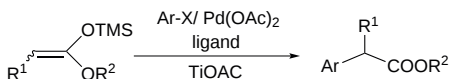


Technical Notes:

1. Homogeneous chiral nickel-catalyzed asymmetric hydrogenation of substituted aromatic α -aminoketone hydrochlorides through dynamic kinetic resolution.
2. Pd/Josiphos-catalyzed enantioselective α -arylation of silyl ketene acetals.
3. Ligand used in the cobalt-catalyzed asymmetric addition of silylacetylenes to 1,1-disubstituted allenes.



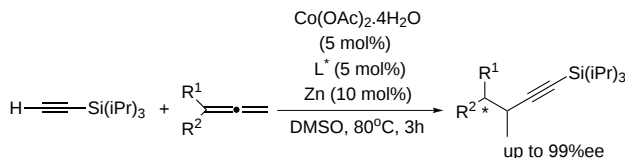
Tech. Note (2)
Ref. (1)



Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

26-1150 (R)-(-)-1-[(S)-2-[Bis(3,5-dimethyl-4-methoxyphenyl)phosphino]ferrocenyl]ethyldi-
(continued) cyclohexylphosphine, min. 97% (360048-63-1)



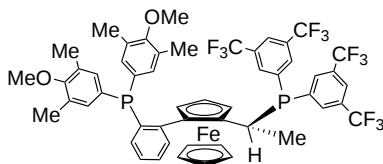
Tech. Note (3)
Ref. (3)

References:

1. *ChemCatChem* **2009**, *1*, 237.
2. *Organometallics* **2011**, *30*, 6323.
3. *J. Org. Chem.*, **2013**, *78*, 8986

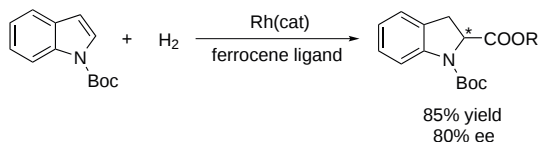
26-1130 (R)-(+)-1-[(R)-2-[2'-Bis(3,5-dimethyl-4-methoxyphenyl)phosphino-phenyl]ferrocenyl] ethylbis(di-3,5-tri fluoromethylphenyl) phosphine, min. 97% (494227-30-4)
 $\text{C}_{52}\text{H}_{44}\text{F}_{12}\text{FeO}_2\text{P}_2$; FW: 1046.68; orange powdr.
Note: Sold in collaboration with Solvias for research purposes only.
Solvias Walphos Ligand Kit component.

100mg
500mg



Technical Note:

1. Ligand for Rh-catalyzed hydrogenation of vinylboronic esters



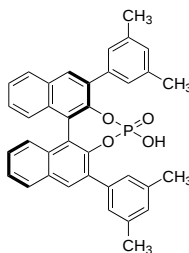
Tech. Note (2)
Ref. (2)

References:

1. *Tetrahedron Asymm.*, **2010**, *21*, 2010.

15-1368 **NEW** (11bR)-2,6-Bis(3,5-dimethylphenyl)-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (861909-53-7)
 $\text{C}_{36}\text{H}_{29}\text{O}_4\text{P}$; FW: 556.6; White to light-yellow powdr.
Note: Sold in collaboration with Daicel for research purposes only.

100mg



15-1369 **NEW** (11bS)-2,6-Bis(3,5-dimethylphenyl)-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (1170736-59-0)
 $\text{C}_{36}\text{H}_{29}\text{O}_4\text{P}$; FW: 556.6; White to light-yellow powdr.
Note: Sold in collaboration with Daicel for research purposes only.

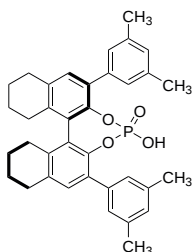
100mg

PHOSPHORUS - Ligands and Compounds

15-1373

NEW

(11bR)-2,6-Bis(3,5-dimethylphenyl)-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)
(1065214-95-0)
 $C_{36}H_{37}O_3P$; FW: 564.7;
White to light-yellow powdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

15-1374

NEW

(11bS)-2,6-Bis(3,5-dimethylphenyl)-8,9,10,11,12,13,14,15-octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)
 $C_{36}H_{37}O_3P$; FW: 564.7; White to light-yellow powdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-0088

amp

HAZ



Bis(3,5-dimethylphenyl)phosphine, 98% (71360-06-0)
 $[(CH_3)_2C_6H_3]_2PH$; FW: 242.30; colorless liq.
pyrophoric

100mg
500mg

15-6185

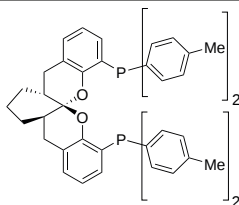
amp

Bis(3,5-dimethylphenyl)phosphine, 98% (10wt% in hexanes)
(71360-06-0)
 $[(CH_3)_2C_6H_3]_2PH$; FW: 242.30; colorless liq.
air sensitive

1g
5g

15-4330

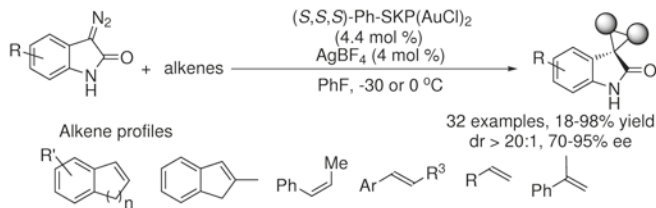
(+)-1,13-Bis[di(4-methylphenyl)phosphino]-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97% (R,R,R)-(+)-Tol-SKP
(1429939-32-1)
 $C_{48}H_{46}O_2P_2$; FW: 716.83; white solid;
m.p. 90-92°
air sensitive
Note: Sold in collaboration with SIOC for research purposes only. Patents PCT/CN2013/071091, CN202110253896.5.
SKP Ligand Kit component.



25mg
100mg

Technical Notes:

- Efficient ligand for the Au(I)-catalyzed, highly stereoselective, olefin cyclopropanation of diazoindoles.
- See also 15-4320.



Tech. Note (1)
Ref. (1)

References:

- J. Am. Chem. Soc., **2013**, 135, 8197.
- Angew. Chem., Int. Ed. **2012**, 51, 936.

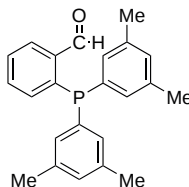
PHOSPHORUS - Ligands and Compounds

15-4331	(-)-1,13-Bis[di(4-methylphenyl)phosphino]-(5aS,8aS,14aS)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano[3,2-d]xanthene, 97% (S,S,S)-(-)-Tol-SKP (1548897-80-8) $C_{48}H_{46}O_2P_2$; FW: 716.83; white powdr.; m.p. 90-92° <i>air sensitive</i>	25mg 100mg
	Note: Sold in collaboration with SIOC for research purposes only. Patents PCT/CN2013/071091, CN202110253896.5. SKP Ligand Kit component.	

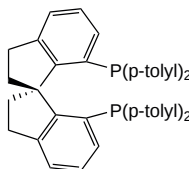
Technical Note:

- See 15-4330 (page 49)

15-7340	2-[Bis(3,5-dimethylphenyl)phosphino]benzaldehyde, min. 97% (669091-00-3) $C_{23}H_{23}OP$; FW: 346.40; yellow solid	100mg 500mg
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15-5180	(R)-(+)-7,7'-Bis[di(4-methylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (R)-Tol-SDP (528521-87-1) $C_{45}H_{42}P_2$; FW: 644.76; white solid; m.p. 150-152° <i>air sensitive</i> Note: Spiro Bisphosphine Ligand Kit component.	25mg 100mg
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Technical Notes:

- Ligands used for the ruthenium-catalyzed hydrogenation of simple and cyclic ketones with high activity and enantioselectivity.
- Ligands used for palladium-catalyzed asymmetric allylic alkylations.

References:

- J. Am. Chem. Soc.*, **2003**, 125, 4404.
- J. Org. Chem.*, **2005**, 70, 2967.
- Adv. Synth. Catal.*, **2004**, 346, 625.

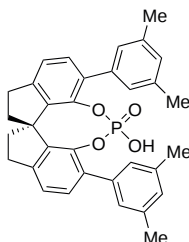
15-5181	(S)-(-)-7,7'-Bis[di(4-methylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (S)-Tol-SDP (817176-80-0) $C_{45}H_{42}P_2$; FW: 644.76; white solid; m.p. 150-152° <i>air sensitive</i> Note: Spiro Bisphosphine Ligand Kit component.	25mg 100mg
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Technical Note:

- See 15-5180 (page 50)

15-0542	(11aR)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1297613-75-2) $C_{33}H_{31}O_4P$; FW: 522.57; white to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.	25mg 100mg
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NEW

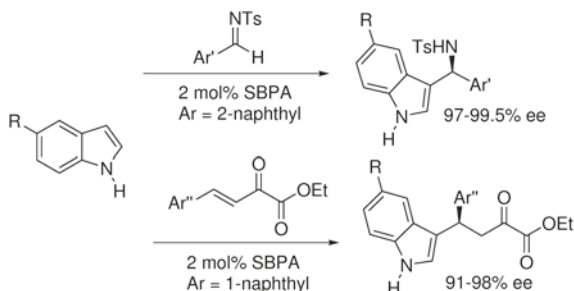


Technical Note:

- Spinol-based phosphoric acid (SBPA) as a highly enantioselective catalyst for asymmetric organocatalysis.

PHOSPHORUS - Ligands and Compounds

15-0542 (11aR)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diinden-
(continued) no[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1297613-75-2)

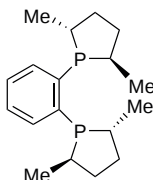


Tech. Note (1)
Ref. (1)

References:

1. J. Org. Chem., 2011, 76, 4125.

15-0543 	(11aS)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diinden[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1412439-82-7) $C_{33}H_{31}O_4P$; FW: 522.57; white to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.	25mg 100mg
15-0090 amp HAZ	1,2-Bis(dimethylphosphino)ethane, 98% DMPE (23936-60-9) $(CH_3)_2PCH_2CH_2P(CH_3)_2$; FW: 150.14; colorless liq.; b.p. 180°; f.p. 2°F; d. 0.90 <i>air sensitive</i>	250mg 1g 5g
15-0093 amp HAZ 	Bis(dimethylphosphino)methane, min. 98% (64065-08-3) $(CH_3)_2PCH_2P(CH_3)_2$; FW: 136.12; colorless liq.; b.p. 42°/12 mm; d. 0.86 <i>air sensitive, pyrophoric</i>	1g 5g
15-0096	(-)-1,2-Bis((2R,5R)-2,5-dimethylphospholano)benzene, 98+% (R,R)-Me-DUPHOS (147253-67-6) $C_{18}H_{28}P_2$; FW: 306.37; white xtl.; m.p. 82-84° <i>air sensitive</i>	100mg 500mg 2g

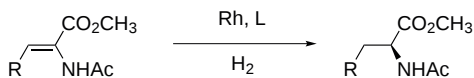


Technical Notes:

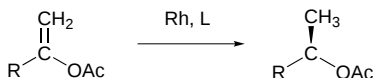
1. The DUPHOS family of catalysts is highly efficient for the asymmetric hydrogenation of various substituted acetamidoacrylates and enol acetates yielding products of high enantiomeric excesses.¹ Efficient ligand for the asymmetric hydrogenation of imines, enamines, and enamides.²
2. Asymmetric hydrogenation of vinyl alcohols.²
3. Catalyst used for the asymmetric hydrogenation of enol phosphonates.⁴
4. Asymmetric hydrogenation of allylic alcohols.⁵
5. Ligand for the catalytic asymmetric [4+1] cycloaddition of vinylallenes with CO.⁵
6. Ligand for the Rh-catalyzed asymmetric enyne cycloisomerization.⁶
7. Catalytic enantioselective addition of dialkylzinc to N-Diphenylphosphinoylimines.⁸
8. Palladium-catalyzed asymmetric phosphination.⁹
9. Palladium-catalyzed asymmetric hydrogenation of carbonyls.¹⁰
10. Palladium-catalyzed 1,4 arylation of α , β -unsaturated ketones.¹¹
11. Asymmetric, Ir-catalyzed, [2+2+2] cycloaddition.¹²
12. Asymmetric palladium-catalyzed synthesis of 2-methyl-indolines via C-H activation.¹³
13. Copper-catalyzed monoborylation of 1,3-Dienes.¹⁴
14. Rhodium-catalyzed enantioselective transmetalation.¹⁵
15. CuH-catalyzed hydroamination of styrenes.¹⁶

PHOSPHORUS - Ligands and Compounds

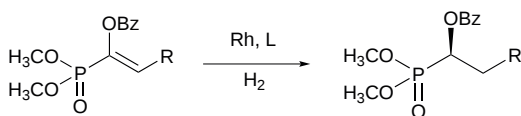
15-0096 (-)-1,2-Bis((2R,5R)-2,5-dimethylphospholano)benzene, 98+%
(continued) (R,R)-Me-DUPHOS (147253-67-6)



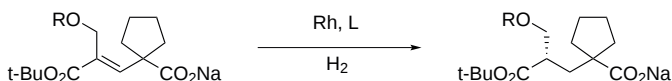
Tech. Note (1)
Ref. (2)



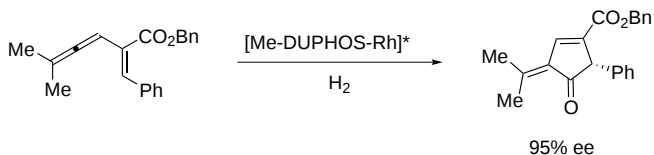
Tech. Note (2)
Ref. (3)



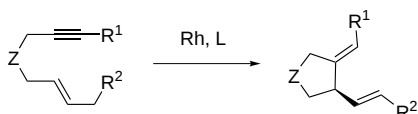
Tech. Note (3)
Ref. (4)



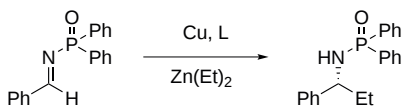
Tech. Note (4)
Ref. (5)



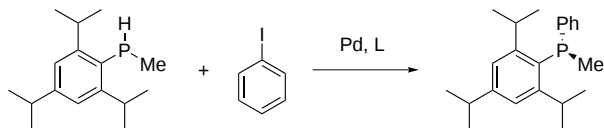
Tech. Note (5)
Ref. (6)



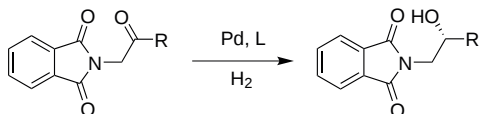
Tech. Note (6)
Ref. (7)



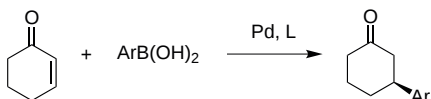
Tech. Note (7)
Ref. (8)



Tech. Note (8)
Ref. (9)



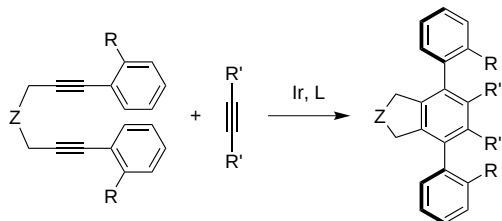
Tech. Note (9)
Ref. (10)



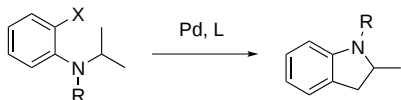
Tech. Note (10)
Ref. (11)

PHOSPHORUS - Ligands and Compounds

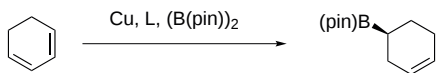
15-0096 (-)-1,2-Bis((2R,5R)-2,5-dimethylphospholano)benzene, 98+%
(continued) (R,R)-Me-DUPHOS (147253-67-6)



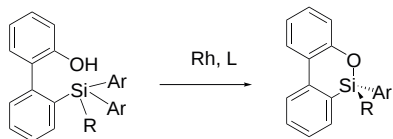
Tech. Note (11)
Ref. (12)



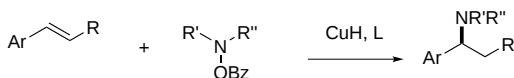
Tech. Note (12)
Ref. (13)



Tech. Note (13)
Ref. (14)



Tech. Note (14)
Ref. (15)



Tech. Note (15)
Ref. (16)

References:

- (a) Burk, M.J., *Handbook of Chiral Chemicals*, Abel, Ager, D.J., Ed. (Marcel Dekker, Inc., New York, 1999) Ch 18, p 339. (review). (b) *Acc. Chem. Res.*, **2000**, 33, 363. (review)
- (a) *J. Am. Chem. Soc.*, **1993**, 115, 10125. (b) *J. Am. Chem. Soc.*, **1992**, 114, 6266. (c) *J. Am. Chem. Soc.*, **1996**, 118, 5142. (d) *Tetrahedron Lett.*, **1999**, 40, 6685. (e) *J. Am. Chem. Soc.*, **1995**, 117, 9375.
- J. Am. Chem. Soc.*, **1991**, 113, 8518.
- Org. Lett.*, **1999**, 1, 387.
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- Angew. Chem. Int. Ed.*, **2000**, 39, 4104.
- J. Am. Chem. Soc.*, **2003**, 125, 1692.
- J. Am. Chem. Soc.*, **2002**, 124, 13356.
- Org. Lett.*, **2005**, 7, 3235.
- Org. Lett.*, **2005**, 7, 5309.
- J. Am. Chem. Soc.*, **2004**, 126, 8382.
- Chem. Commun.*, **2011**, 47, 11483.
- J. Am. Chem. Soc.*, **2010**, 132, 1226.
- J. Am. Chem. Soc.*, **2012**, 134, 16955.
- Angew. Chem. Int. Ed.*, **2013**, 52, 10830.

15-0092 (+)-1,2-Bis((2S,5S)-2,5-dimethylphospholano)benzene, 98+%
(S,S)-Me-DUPHOS (136735-95-0)
C₁₆H₂₈P₂; FW: 306.37; white xtl.; m.p. 82-84°
air sensitive

100mg
500mg
2g

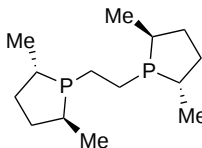
Technical Note:

- See 15-0096 (page 51)

PHOSPHORUS - Ligands and Compounds

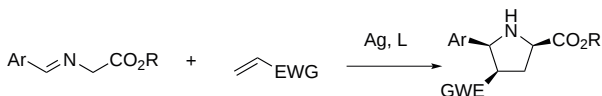
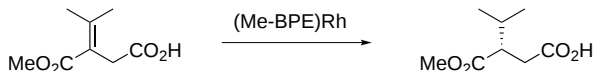
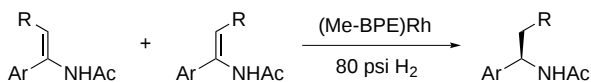
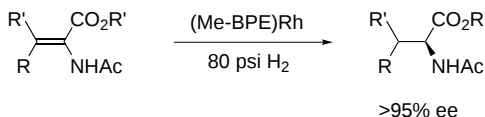
15-0104 (+)-1,2-Bis((2R,5R)-2,5-dimethylphospholano)ethane, **98+% (R,R)-Me-BPE** (129648-07-3)
 $(C_6H_{12})PCH_2CH_2P(C_6H_{12})$; FW: 258.33; colorless to pale-yellow liq.; b.p. 64-67°/0.06mm; d. 0.940
air sensitive

100mg
 500mg
 2g



Technical Notes:

- The DUPHOS family of catalysts is highly efficient for the asymmetric hydrogenation of various substituted acetamidoacrylates and enol acetates yielding products of high enantiomeric excesses. Efficient ligand for the asymmetric hydrogenation of tetrasubstituted enamides.¹
- Silver-catalyzed asymmetric [3+2] cycloaddition reaction.⁴



References:

- J. Am. Chem. Soc., **1995**, *117*, 9375
- J. Am. Chem. Soc., **1996**, *118*, 5142.
- Angew. Chem. Int. Ed., **1998**, *37*, 1931.
- J. Am. Chem. Soc., **2012**, *134*, 12936.

15-0105 (-)-1,2-Bis((2S,5S)-2,5-dimethylphospholano)ethane, **98+% (S,S)-Me-BPE** (136779-26-5)
 $(C_6H_{12})PCH_2CH_2P(C_6H_{12})$; FW: 258.33; colorless to pale-yellow liq.; b.p. 64-67°/0.06mm; d. 0.938
air sensitive

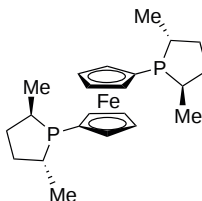
100mg
 500mg
 2g

Technical Note:

- See 15-0104 (page 54)

26-1618 1,1'-Bis((2R,5R)-2,5-dimethylphospholano)ferrocene, **min. 97% (540475-45-4)**
 $C_{22}H_{32}FeP_2$; FW: 414.28; yellow solid
air sensitive
 Note: Sold under license from Kanata for research purposes only.

250mg
 1g

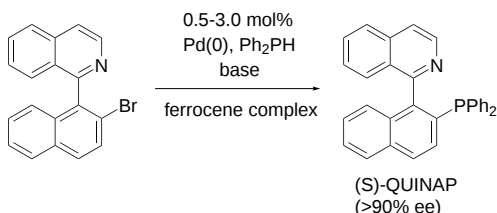


Technical Notes:

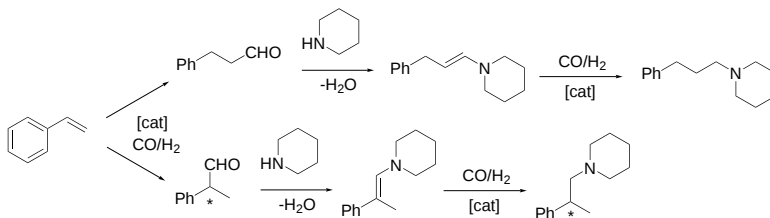
- Ligand for the palladium-catalyzed, atroposelective C-P coupling process for the asymmetric synthesis of QUINAP and its derivatives.
- Ligand for rhodium driven hydroaminomethylation involving styrene and piperidine.

PHOSPHORUS - Ligands and Compounds

26-1618 **1,1'-Bis((2R,5R)-2,5-dimethylphospholano)ferrocene, min. 97% (540475-45-4)**
(continued)



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

1. J. Am. Chem. Soc., **2013**, 135, 16829.
2. ACS Catal., **2014**, 4, 435.

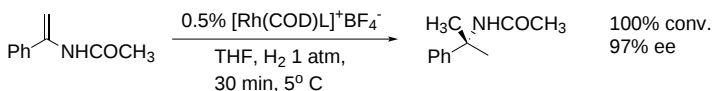
26-1619	1,1'-Bis((2S,5S)-2,5-dimethylphospholano)ferrocene, min. 97% (162412-87-5) C ₂₂ H ₃₂ FeP ₂ ; FW: 414.28; yellow solid air sensitive Note: Sold under license from Kanata for research purposes only.	250mg 1g
15-0099	Bis(4,6-dimethyl-3-sulfonatophenyl)(2,4-dimethylphenyl)phosphine, disodium salt hydrate, min. 95% TXPDS C ₂₄ H ₂₅ Na ₂ O ₆ PS ₂ ; FW: 550.54; white powdr. Note: Water soluble phosphine.	250mg 1g
15-0094	1,2-Bis(dipentafluorophenylphosphino)ethane, 99% (76858-94-1) (C ₆ F ₅) ₂ PCH ₂ CH ₂ P(C ₆ F ₅) ₂ ; FW: 758.26; off-white xtl.; m.p. 188-190°	1g 5g
15-0100	Bis(diphenylphosphino)acetylene, 97% (5112-95-8) (C ₆ H ₅) ₂ PC≡CP(C ₆ H ₅) ₂ ; FW: 394.39; white xtl.; m.p. 85-87°	1g 5g
15-0110	N,N-Bis(diphenylphosphino)amine, min. 98% (2960-37-4) (C ₆ H ₅) ₂ PNHP(C ₆ H ₅) ₂ ; FW: 385.38; white xtl.; m.p. 143-145°	1g 5g
15-0402	(S)-(-)-2,2'-Bis(N-diphenylphosphinoamino)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl, min. 95% CTH-(S)-BINAM (229177-79-1) C ₄₄ H ₄₂ N ₂ P ₂ ; FW: 660.77; white solid Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent US 5919981 and patents arising therefrom.	100mg 500mg

Technical Note:

1. Ligand used in the enantioselective, rhodium-catalyzed hydrogenation of α-phenylenamides.

PHOSPHORUS - Ligands and Compounds

15-0402 (S)-(-)-2,2'-Bis(N-diphenylphosphinoamino)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl, (continued) min. 95% CTH-(S)-BINAM (229177-79-1)



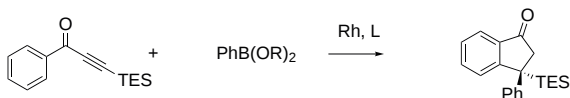
References:

1. *J. Am. Chem. Soc.*, **1998**, *120*, 5808.

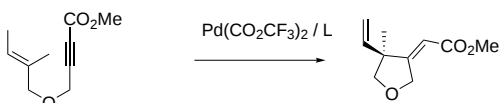
15-0130	1,2-Bis(diphenylphosphino)benzene, 98% (13991-08-7) o-C ₆ H ₄ [P(C ₆ H ₅) ₂] ₂ ; FW: 446.47; white xtl.; m.p. 185-187°	1g 5g
15-7325	(1R,2R)-N,N-Bis[2-(diphenylphosphino)benzyl]cyclohexane-1,2-diamine, min. 97% (174758-63-5) C ₄₄ H ₄₄ N ₂ P ₂ ; FW: 662.78; yellow solid <i>air sensitive</i>	250mg 1g
15-7326	(1S,2S)-N,N-Bis[2-(diphenylphosphino)benzyl]cyclohexane-1,2-di-amine, min. 97% (174677-83-9) C ₄₄ H ₄₄ N ₂ P ₂ ; FW: 662.78; yellow solid <i>air sensitive</i>	250mg 1g
15-0136	(R)-(+)-5,5'-Bis(diphenylphosphino)-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-SEGPHOS® (244261-66-3) C ₃₈ H ₂₈ O ₄ P ₂ ; FW: 610.57; off-white powdr.; m.p. 168-172° Note: Manufactured under license of Takasago patent. Takasago SEGPHOS® Ligand Kit component.	250mg 1g 5g

Technical Notes:

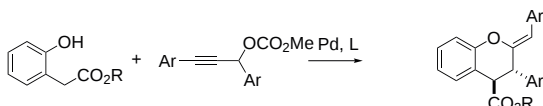
1. Biaryl bisphosphine ligand with narrow dihedral angle. The SEGPHOS® ligand has been applied to a variety of metal catalyzed reactions. In many cases, yields and enantioselectivities, exceed results obtained earlier using BINAP.^{1,2}
2. As ruthenium complex, SEGPHOS® generally gives higher levels of chiral induction in asymmetric hydrogenations of α,β, and γ-functionalized ketones. See ruthenium complexes 44-0096, 44-0518, 44-0168.
3. Used in Rh-catalyzed transformations such as: (a) 1,4-addition of boronic acids to coumarins, 4 (b) addition of titanium reagents to imines, 6 (c) cotrimmerization of alkenes and acetylenes, 10 (d) double [2+2] cycloaddition, 11 (e) indanone formation.^{12a,b}
4. Used in Pd-catalyzed transformations such as: (a) cycloaddition of 1,6-enyne,⁵ (b) arylation cyclization of allenyl aldehydes with boronic acids,¹³ (c) synthesis of chromans.¹⁴
5. Used in Cu-catalyzed transformations such as: (a) nitroso Diels-Alder, 7 (b) reductive aldol condensation,⁹ (c) conjugate reduction of unsaturated sulfones,¹⁵ and phosphonates.¹⁶
6. Iridium-catalyzed asymmetric hydrogenation of quinolines activated by chloroformates.
7. Iridium-catalyzed asymmetric transfer hydrogenation used in polyketide construction.¹⁷
8. Rhodium-catalyzed asymmetric hydroarylation of 3-pyrrolines.¹⁸
9. Palladium-catalyzed regio- and enantioselective dearomatization of pyrroles to 2H-pyrroles.¹⁹
10. Rhodium-catalyzed asymmetric synthesis of cyclopentanols.²⁰
11. Silver-catalyzed asymmetric Mannich-type reaction.²¹



Tech. Note (3)
Ref. (12a)

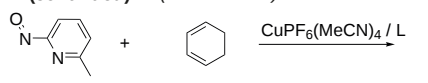
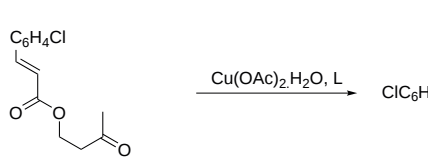
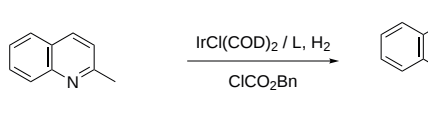
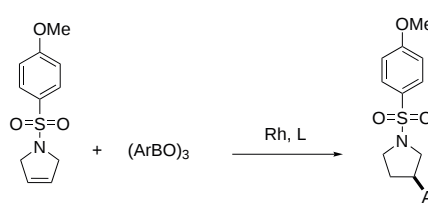
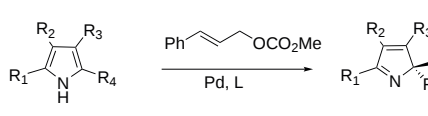
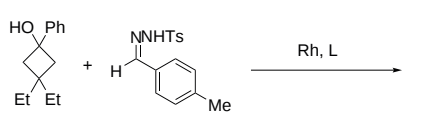
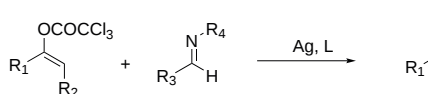


Tech. Note (4)
Ref. (5)



Tech. Note (4)
Ref. (14)

PHOSPHORUS - Ligands and Compounds

15-0136 (continued)	(R)-(+)-5,5'-Bis(diphenylphosphino)-4,4'-bi-1,3-benzodioxole, min. 98% (R)-(+)-SEGPHOS® (244261-66-3)
	Tech. Note (5) Ref. (7)
	Tech. Note (5) Ref. (9)
	Tech. Note (6) Ref. (8)
	Tech. Note (8) Ref. (18)
	Tech. Note (9) Ref. (19)
	Tech. Note (10) Ref. (20)
	Tech. Note (11) Ref. (21)

References:

1. *Tetrahedron*, **2005**, 61, 5405.
1. *Org. Lett.*, **2008**, 10, 2825.
2. *Topics Organometal. Chem.*, **2004**, 6, 63.
3. *Org. Lett.*, **2003**, 5, 5043.
4. *Org. Lett.*, **2005**, 7, 2285.
5. *Angew. Chem. Int. Ed.*, **2001**, 40, 249.
6. *Angew. Chem. Int. Ed.*, **2004**, 43, 6125.
7. *J. Am. Chem. Soc.*, **2004**, 126, 4128.
8. *Angew. Chem. Int. Ed.*, **2006**, 45, 2260.
9. *Org. Lett.*, **2005**, 7, 4225.
10. *Org. Lett.*, **2008**, 10, 2849.
12. (a) *Angew. Chem. Int. Ed.*, **2007**, 46, 3735. (b) *Org. Lett.*, **2006**, 8, 3379.
13. *Org. Lett.*, **2008**, 10, 1047.
14. *Org. Lett.*, **2009**, 11, 4752.
15. *Angew. Chem.*, **2007**, 119, 3393.
16. *Tetrahedron Lett.*, **2009**, 50, 6720.
17. *J. Am. Chem. Soc.*, **2011**, 133, 12795.
18. *J. Am. Chem. Soc.*, **2013**, 135, 10990.
19. *J. Am. Chem. Soc.*, **2014**, 136, 6590.
20. *J. Am. Chem. Soc.*, **2014**, 136, 7217.
21. *Org. Lett.*, **2014**, 16, 86.

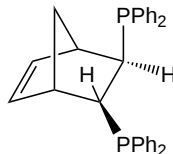
PHOSPHORUS - Ligands and Compounds

15-0137	(S)-(-)-5,5'-Bis(diphenylphosphino)-4,4'-bi-1,3-benzodioxole, min. 98% (S)-(-)-SEGPHOS® (210169-54-3) $C_{38}H_{28}O_2P_2$; FW: 610.57; off-white powdr.; m.p. 168-172° Note: Manufactured under license of Takasago patent. Takasago SEGPHOS® Ligand Kit component.	250mg 1g 5g
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Technical Note:

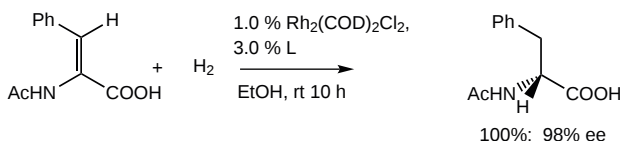
1. See 15-0136 (page 56)

15-0140	(2R,3R)-(-)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (R,R)-NORPHOS (71042-55-2) $C_{31}H_{28}P_2$; FW: 462.51; white xtl.; m.p. 116-119° <i>air sensitive</i>	250mg 1g
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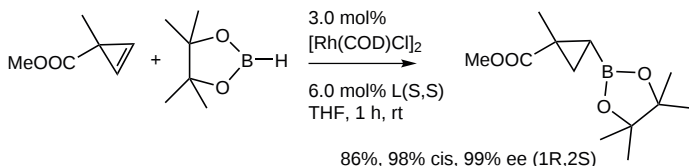


Technical Notes:

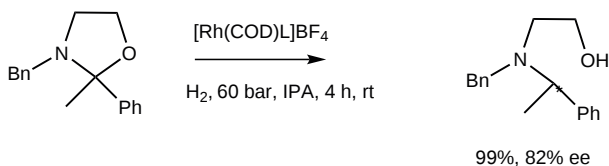
1. Ligand used in the enantioselective rhodium catalyzed hydrogenation of α -dehydroaminoesters and enamides.
2. Ligand used in the enantioselective rhodium catalyzed hydroboration of cyclopropenes.
3. Ligand used in the asymmetric rhodium catalyzed cleavage of racemic 1,3-oxazolidines.
4. Iridium or Rhodium-catalyzed asymmetric Diels-Alder reaction.⁴



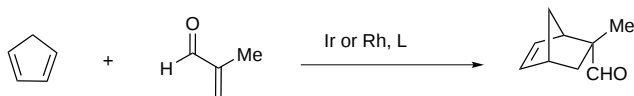
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

References:

1. *Angew. Chem.*, **1979**, 91, 655.
2. *J. Am. Chem. Soc.*, **2003**, 125, 7198.
3. *Adv. Synth. Catal.*, **2003**, 345, 239.
4. *Organometallics*, **2011**, 30, 6661.

15-0141	(2S,3S)-(+)-2,3-Bis(diphenylphosphino)-bicyclo[2.2.1]hept-5-ene, min. 95% (S,S)-NORPHOS (71042-54-1) $C_{31}H_{28}P_2$; FW: 462.51; white xtl.; m.p. 112-115° <i>air sensitive</i>	250mg 1g
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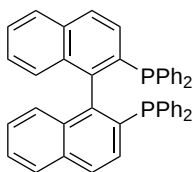
Technical Note:

1. See 15-0140 (page 58)

PHOSPHORUS - Ligands and Compounds

15-0433

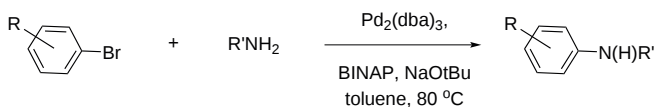
racemic-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% rac-BINAP
(98327-87-8)
 $C_{44}H_{32}P_2$; FW: 622.70; white to light-yellow xtl.
Note: Phosphine Ligand Kit component.



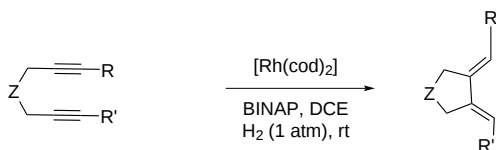
1g
5g
25g
100g

Technical Notes:

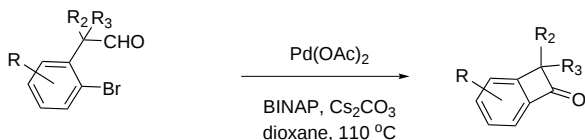
1. Useful ligand for palladium-catalyzed carbon-nitrogen bond formation.
2. Useful ligand for rhodium-catalyzed C-C bond formation.
3. Useful ligand for palladium-catalyzed intramolecular acylation of aryl bromides via C-H activation.
4. Used in the preparation of Buchwald third generation precatalyst.
5. Used in methoxy directed Rhodium migration.
6. Used in Nickel catalyzed C-N cross-coupling reactions.



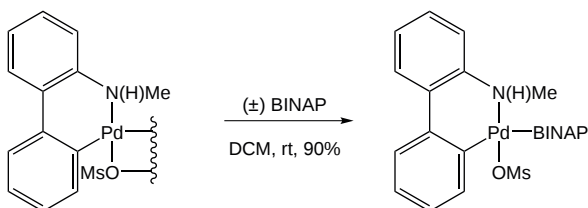
Tech. Note (1)
Ref. (1)



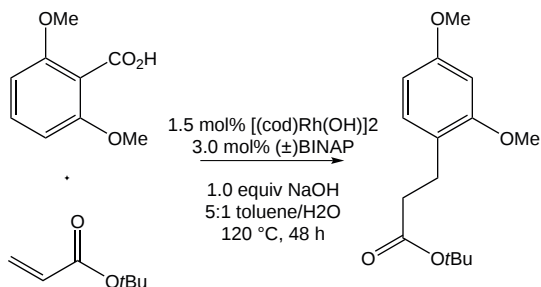
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



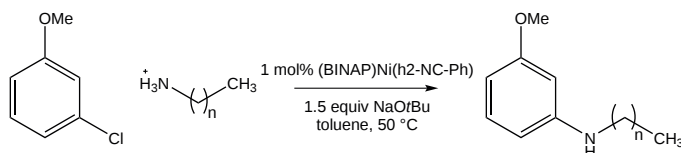
Tech. Note (4)
Ref. (6)



Tech. Note (5)
Ref. (7)

PHOSPHORUS - Ligands and Compounds

15-0433 **racemic-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% rac-BINAP (98327-87-8)**
(continued)

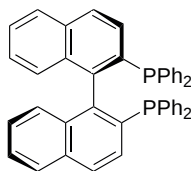


Tech. Note (6)
Ref. (8)

References:

1. *J. Org. Chem.*, **2000**, 65, 1144.
2. *Acc. Chem. Rec.*, **1998**, 31, 805. (review article)
3. *Chem. Rev.*, **2003**, 3, 169. (review article)
4. *J. Am. Chem. Soc.*, **2004**, 126, 7875.
5. *J. Am. Chem. Soc.*, **2010**, 132, 466.
6. *J. Org. Chem.*, **2014**, 79, 4161.
7. *J. Am. Chem. Soc.*, **2013**, 135, 17270.
8. *J. Am. Chem. Soc.*, **2014**, 136, 1617.

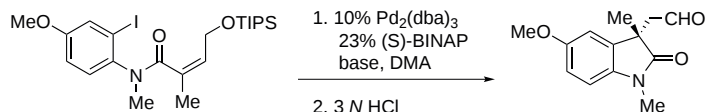
15-0150 (R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP (76189-55-4)
C₄₄H₃₂P₂; FW: 622.70; white to off-white powdr.; m.p. 240.5-242°
Note: Manufactured under license of Takasago patent. Takasago BINAP Ligand Kit component.



250mg
1g
5g

Technical Notes:

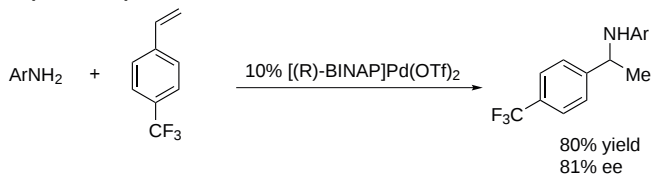
1. (R)-BINAP or (R)-Tol-BINAP can be combined with dichloro(1,5-cyclooctadiene)ruthenium to form precursors to NOYORI CATALYST SYSTEMS. These systems exhibit very high catalytic activity and enantioselectivity in the hydrogenation of a wide range of substrates. NOYORI CATALYST SYSTEMS have been shown to effect highly enantioselective hydrogenation of functionalized ketones where the substituents are dialkylamino, hydroxy, siloxy, carbonyl, ester, amide or thioester.
2. Useful ligand in asymmetric Heck processes.
3. Ligand employed in palladium-catalyzed asymmetric arylation of ketones.
4. Ligand employed in rhodium-catalyzed 1,4-additions to enones.
5. Ligand employed in palladium-catalyzed hydroamination of styrene derivatives.
6. Ligand employed in silver-catalyzed asymmetric Sakuri-Hosomi allylation and Mukaiyama aldol reaction.
7. Ligand employed in rhodium-catalyzed kinetic resolution of enynes.
8. Ligand employed in asymmetric rhodium-catalyzed hydroboration of cyclopropenes.
9. Ligand employed in silver-catalyzed α-hydroxylation of stannyl enol ethers.
10. Ligand employed in palladium-catalyzed synthesis of chiral allenes.
11. Ligand for palladium-catalyzed enantioselective hetero Michael addition to form β-amino acid derivatives.
12. Ligand employed in rhodium-catalyzed asymmetric rearrangement of alkynyl alkenyl carbinols.
13. Ligand employed in rhodium-catalyzed 1,2-addition of aluminium organyl compounds to cyclic enones.
14. Ligand employed in iridium-catalyzed transfer hydrogenative allylation of benzylic alcohols.
15. Ligand employed in rhodium-catalyzed asymmetric C-Si bond formation by conjugate silyl transfer using a Si-B linkage.
16. Ligand employed in the iridium-catalyzed asymmetric cyclopropane-mediated carbonyl allylation of primary alcohols.
17. Ligand employed in the nickel-catalyzed asymmetric α-arylation of tetralones.
18. Ligand employed in the copper-catalyzed asymmetric propargylation of ketones.
19. Ligand employed in the cobalt-catalyzed asymmetric reductive coupling of alkynes with alkenes.
20. Ligand employed in the rhodium-catalyzed asymmetric 1,4-addition of arylalanes on trisubstituted enones.
21. Ruthenium-catalyzed asymmetric hydrocyanation of imines.
22. Palladium-catalyzed asymmetric intermolecular cyclization.



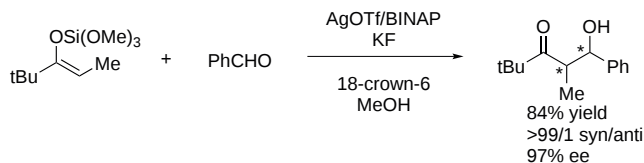
Tech. Note (2)
Ref. (5)

PHOSPHORUS - Ligands and Compounds

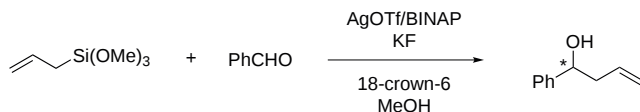
15-0150 (R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP (76189-55-4)
(continued)



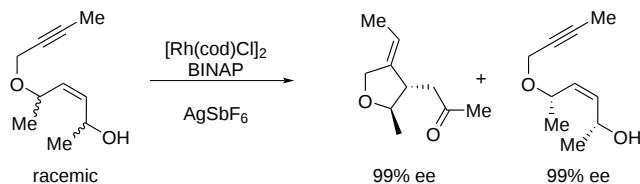
Tech. Note (5)
Ref. (9)



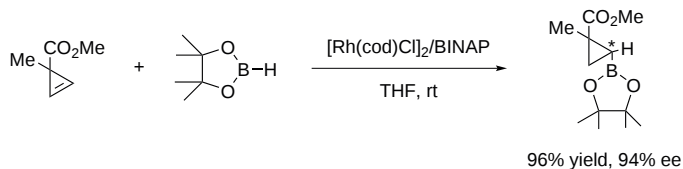
Tech. Note (6)
Ref. (10)



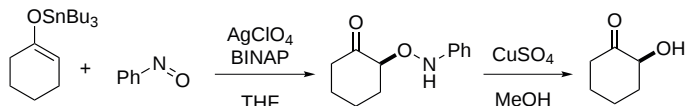
Tech. Note (6)
Ref. (10)



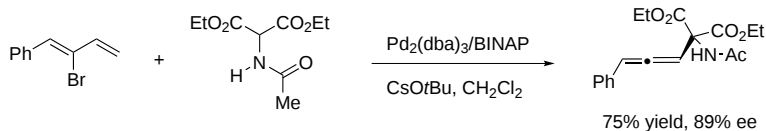
Tech. Note (7)
Ref. (11)



Tech. Note (8)
Ref. (12)



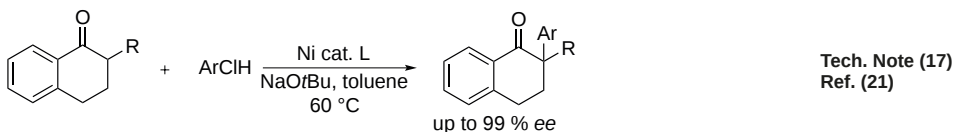
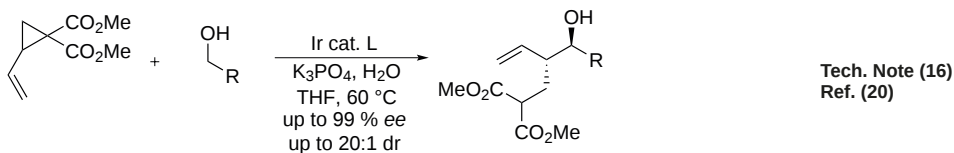
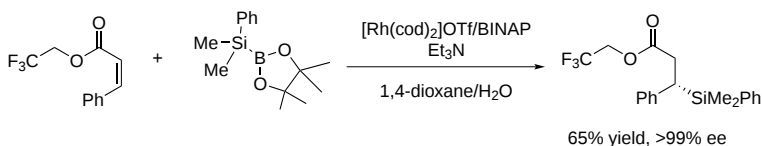
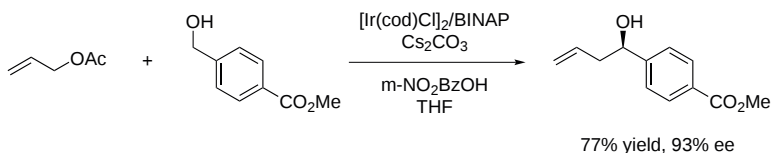
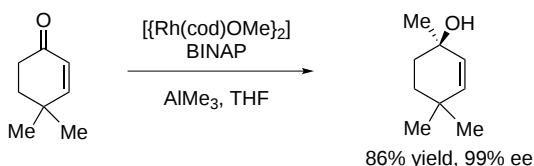
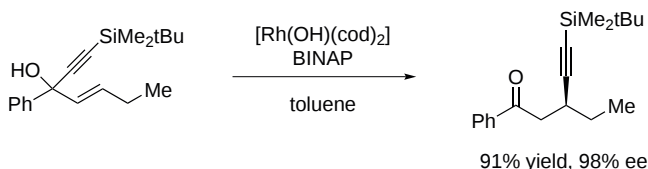
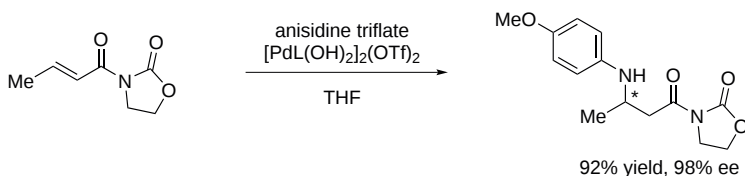
Tech. Note (9)
Ref. (13)



Tech. Note (10)
Ref. (14)

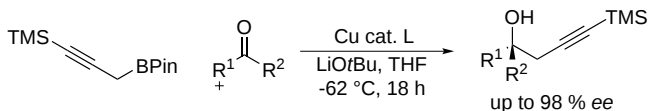
PHOSPHORUS - Ligands and Compounds

15-0150 (R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP (76189-55-4)
(continued)

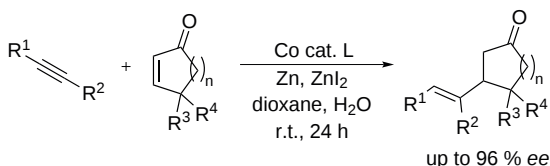


PHOSPHORUS - Ligands and Compounds

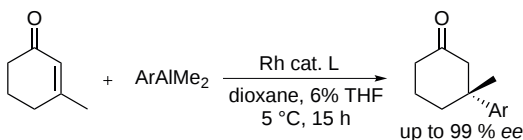
15-0150 (R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-BINAP (76189-55-4)
(continued)



Tech. Note (18)
Ref. (22)



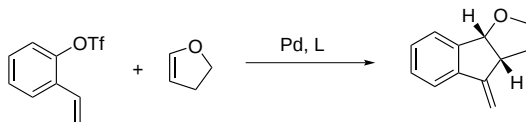
Tech. Note (19)
Ref. (23)



Tech. Note (20)
Ref. (24)



Tech. Note (21)
Ref. (25)



Tech. Note (22)
Ref. (26)

References:

1. *CHEMTECH*, **1992**, 360.
2. *Asymmetric Catalysis in Organic Synthesis*, **1993**, 61.
3. *J. Am. Chem. Soc.*, **1988**, *110*, 629.
4. *Science*, **1990**, *248*, 1194.
5. *J. Am. Chem. Soc.*, **1998**, *120*, 6477.
6. *Encyclopedia of Reagents for Organic Synthesis*, **1995**, Vol. 1, 509.
7. *J. Am. Chem. Soc.*, **1998**, *120*, 1918.
8. *J. Am. Chem. Soc.*, **1998**, *120*, 5579.
9. *J. Am. Chem. Soc.*, **2000**, *122*, 9547.
10. *J. Org. Chem.*, **2003**, *68*, 5593.
11. *J. Am. Chem. Soc.*, **2003**, *125*, 11472.
12. *J. Am. Chem. Soc.*, **2003**, *125*, 7198.
13. *J. Am. Chem. Soc.*, **2003**, *125*, 6038.
14. *J. Am. Chem. Soc.*, **2001**, *123*, 2089.
15. US Patent Application US2006/0205968.
16. *J. Am. Chem. Soc.*, **2007**, *129*, 14158.
17. *Angew. Chem. Int. Ed.*, **2007**, *46*, 7122.
18. *J. Am. Chem. Soc.*, **2008**, *130*, 14891.
19. *Angew. Chem. Int. Ed.*, **2008**, *47*, 3818.
20. *J. Am. Chem. Soc.*, **2011**, *133*, 18618.
21. *J. Am. Chem. Soc.*, **2011**, *133*, 16330.
22. *J. Am. Chem. Soc.*, **2011**, *133*, 10332.
23. *J. Am. Chem. Soc.*, **2011**, *133*, 6942.
24. *Angew. Chem. Int. Ed.*, **2010**, *49*, 7769.
25. *Org. Lett.*, **2012**, *14*, 882.
26. *Angew. Chem., Int. Ed.*, **2013**, *52*, 8676.

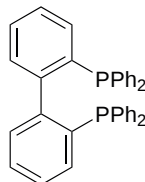
PHOSPHORUS - Ligands and Compounds

15-0151	(S)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98%	250mg
	(S)-(-)-BINAP (76189-56-5)	1g
	C ₄₄ H ₃₂ P ₂ ; FW: 622.70; white to off-white powdr.; m.p. 241-242°	5g
	Note: Manufactured under license of Takasago patent. Takasago BINAP Ligand Kit component.	

Technical Note:

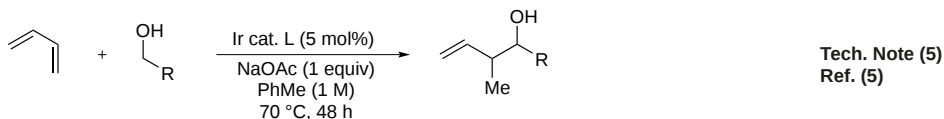
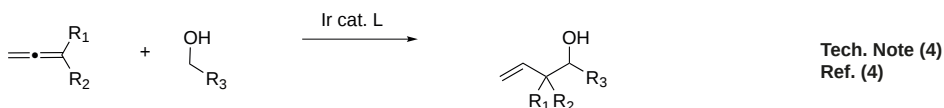
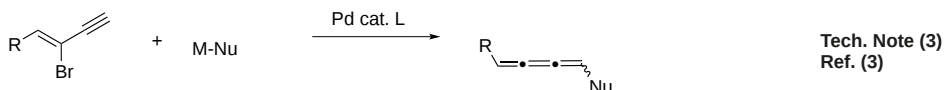
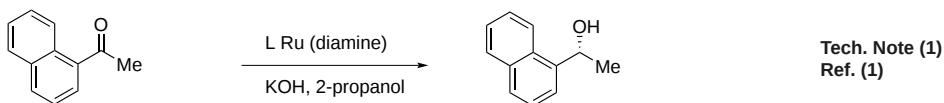
1. See 15-0150 (page 60)

15-0145	2,2'-Bis(diphenylphosphino)-1,1'- biphenyl, 98%	250mg
	BIPHEP (84783-64-2)	1g
	C ₃₆ H ₂₈ P ₂ ; FW: 522.57; white xtl.; m.p. 210-214°	5g



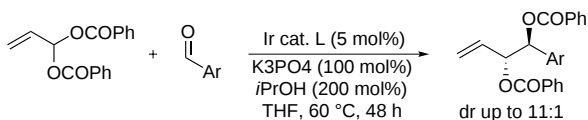
Technical Notes:

1. Supporting ligand in a chiral diamine-ruthenium system for the enantioselective hydrogenation of ketones.
2. Useful ligand for palladium-catalyzed amination and Kumada cross-coupling reactions
3. Useful ligand for palladium-catalyzed synthesis of butatrienes.
4. Useful ligand for iridium-catalyzed C-C cross-coupling of allenes with primary alcohols via transfer hydrogenation.
5. Useful ligand for iridium-catalyzed C-C cross-coupling of dienes with primary alcohols via transfer hydrogenation.
6. Useful ligand for iridium-catalyzed C-C cross-coupling of allylic gem-dicarboxylates with aldehydes via transfer hydrogenation.
7. Useful ligand for the palladium-catalyzed synthesis of chiral allenylsilanes.
8. Ruthenium-catalyzed synthesis of indoles.
9. Ruthenium-catalyzed oxidative cyclization.
10. Rhodium-catalyzed boron arylation.

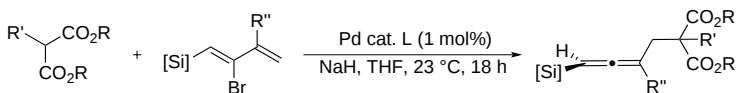


PHOSPHORUS - Ligands and Compounds

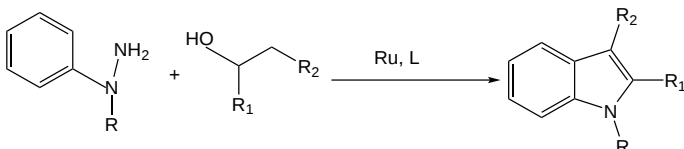
15-0145 2,2'-Bis(diphenylphosphino)-1,1'- biphenyl, 98% BIPHEP (84783-64-2)
(continued)



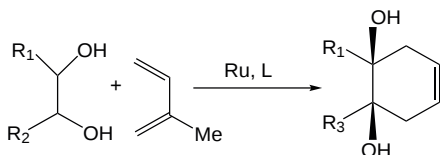
Tech. Note (6)
Ref. (6)



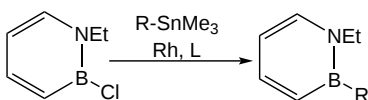
Tech. Note (7)
Ref. (7)



Tech. Note (8)
Ref. (8)



Tech. Note (9)
Ref. (9)



Tech. Note (10)
Ref. (10)

References:

1. *Angew. Chem. Int. Ed.*, **1999**, 38, 495.
2. *Organometallics*, **2000**, 19, 1567.
3. *Chem. Lett.*, **2000**, 776.
4. *J. Am. Chem. Soc.*, **2007**, 129, 15134.
5. *Adv. Synth. Catal.*, **2010**, 352, 2416.
6. *J. Am. Chem. Soc.*, **2010**, 132, 1760.
7. *Org. Lett.*, **2010**, 12, 5736.
8. *Org. Lett.*, **2012**, 14, 6112.
9. *J. Am. Chem. Soc.*, **2013**, 135, 3796.
10. *Angew. Chem. Int. Ed.*, **2013**, 52, 9316.

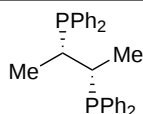
15-0160 (2S,3S)-(-)-Bis(diphenylphosphino)butane

(S,S)-CHIRAPHOS (64896-28-2)

(C₆H₅)₂PCH(CH₃)CH(CH₃)P(C₆H₅)₂; FW: 426.48; white

xtl.; m.p. 108-109°

air sensitive



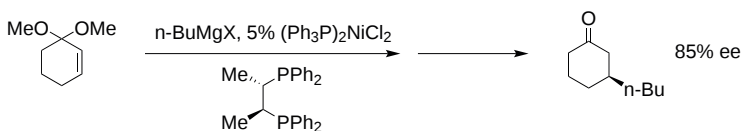
250mg

1g

5g

Technical Note:

1. Useful as a ligand in the Ni-catalyzed asymmetric additions to allylic ketals.



85% ee

References:

1. *J. Am. Chem. Soc.*, **1998**, 120, 7649.

PHOSPHORUS - Ligands and Compounds

15-0170	1,4-Bis(diphenylphosphino)butane, 98% DPPB (7688-25-7) (C ₆ H ₅) ₂ PCH ₂ CH ₂ CH ₂ CH ₂ P(C ₆ H ₅) ₂ ; FW: 426.48; white xtl.; m.p. 132-134°	2g 10g 50g
15-0183	4,6-Bis(diphenylphosphino) dibenzofuran, 98% DBFphos (133850-81-4) C ₃₆ H ₂₆ OP ₂ ; FW: 536.54; white powdr.	100mg 500mg 2g
15-0176	(S)-(+)-1,13-Bis(diphenylphosphino)-7,8-dihydro-6H-dibenzo[f,h][1,5]dioxonin, 95% (S)-C₃-TUNEPHOS (486429-99-6) C ₃₉ H ₃₂ O ₃ P ₂ ; FW: 594.62; white powdr. <i>air sensitive</i> Note: Sold in collaboration with Chiral Quest for research purposes only. US Patent No. 6,521,769; additional patents pending. Chiral Quest Catalyst and Ligand Toolbox Kit component.	100mg 500mg

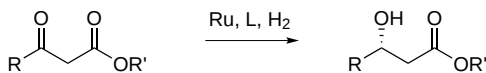
Technical Note:

1. See 15-0175 (page 66)

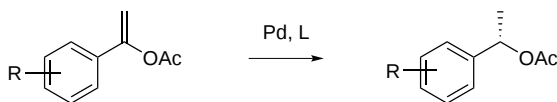
15-0175	R-(-)-1,13-Bis(diphenylphosphino)-7,8-dihydro-6H-dibenzo[f,h][1,5]dioxonin, 97% (R)-C₃-TUNEPHOS (301847-89-2) C ₃₉ H ₃₂ O ₃ P ₂ ; FW: 594.62; white powdr. <i>air sensitive</i> Note: Sold in collaboration with Chiral Quest for research purposes only. US Patent No. 6,521,769; additional patents pending. Chiral Quest Catalyst and Ligand Toolbox Kit component.	100mg 500mg
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Technical Notes:

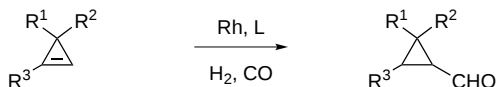
1. New generation of chiral biaryl phosphine ligands with tunable dihedral angles. The ability to modify the dihedral angle allows for the fine tuning of the catalyst system and optimization of enantioselectivity.
2. Ru-C₃-TUNEPHOS complexes are used for asymmetric hydrogenation of β-ketoesters¹, enol acetates², cyclic β-amino acids³, α-phthalimide ketones⁴, and α-keto esters⁵.
3. Rh-catalyzed hydroformylation of cyclopropenes.



Tech. Note (2)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (6)

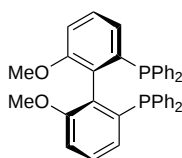
References:

1. J. Org. Chem., **2000**, 65, 6223.
2. Org. Lett., **2002**, 4, 4495.
3. J. Am. Chem. Soc., **2003**, 125, 9570.
4. J. Am. Chem. Soc., **2004**, 126, 1626.
5. Synlett., **2006**, 126, 1169.
6. J. Am. Chem. Soc., **2008**, 130, 13804.

PHOSPHORUS - Ligands and Compounds

15-0178

(R)-(+)-2,2'-Bis(diphenylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (R)-MeO-BIPHEP (133545-16-1)
 $C_{38}H_{32}O_2P_2$; FW: 582.53; off-white xtl.
 Note: Sold in collaboration with Solvias for research purposes only. Solvias (R)-MeO-BIPHEP Ligand Kit component.

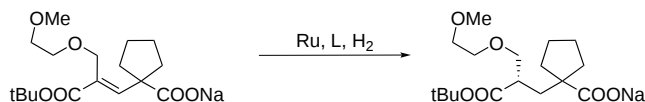


100mg
 500mg
 2g
 10g

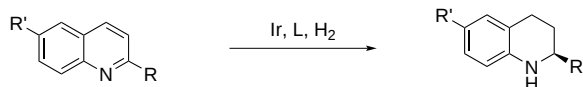
In many respects the catalytic profile of the MeOBIPHEP ligands is similar to that of other atropisomeric diphosphines such as binap and its many analogs. The nature of the PR₂ group strongly influences the catalytic performance of the metal complexes. The rhodium and ruthenium MeO-BIPHEP catalysts are highly effective for the hydrogenation of various C=O, C=C and C=N bonds and several synthetically useful C-C coupling reactions

Technical Notes:

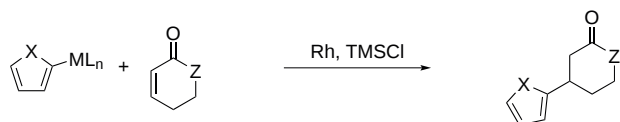
1. See 15-0042.
2. Ru and Ir catalyzed dynamic kinetic resolution for the synthesis of hydroxy, amino acid derivatives.
3. Ru-catalyzed asymmetric hydrogenation of ketones and alkenes.
4. Ir catalyzed enantioselective hydrogenation of heteroaromatic compounds.
5. Conjugate addition using 2-heteroaryl titanates and zinc reagents.
6. Enantio- and regioselective heck-type reaction of aryl boronic acids with 2,3-dihydrofuran
7. Rhodium-catalyzed carbonyl Z-dienylation.
8. Rhodium-catalyzed asymmetric 1,4 addition of arylboronic acids to maleimides and enones.



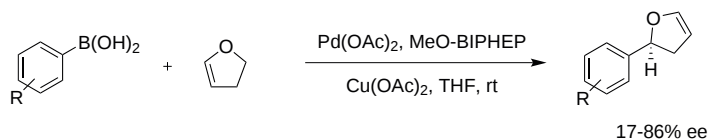
Tech. Note (3)
 Ref. (3)



Tech. Note (4)
 Ref. (4)

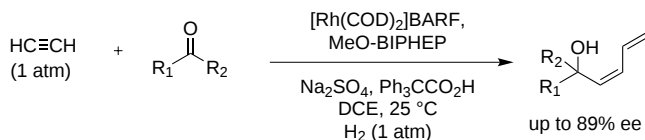


Tech. Note (5)
 Ref. (5)



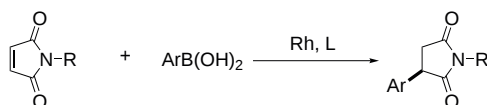
Tech. Note (6)
 Ref. (6)

17-86% ee



Tech. Note (7)
 Ref. (7)

up to 89% ee



Tech. Note (8)
 Ref. (8)

References:

1. *Adv. Synth. Catal.*, **2004**, 346, 842.
2. *Org. Lett.*, **2006**, 8, 4573.
3. *Org. Process Res. Devel.*, **2001**, 5, 438.
4. *J. Am. Chem. Soc.*, **2003**, 125, 10536.
5. *Org. Lett.*, **2009**, 11, 4200.
6. *J. Org. Chem.*, **2007**, 72, 3875.
7. *J. Am. Chem. Soc.*, **2006**, 128, 16040.
8. *J. Org. Chem.*, **2011**, 76, 6925.

PHOSPHORUS - Ligands and Compounds

15-0179	(S)-(-)-2,2'-Bis(diphenylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%	100mg
	(S)-MeO-BIPHEP (133545-17-2)	500mg
	C ₃₈ H ₃₂ O ₂ P ₂ ; FW: 582.53; white xtl.	2g
	Note: Sold in collaboration with Solvias for research purposes only. Solvias (S)-MeO BIPHEP Ligand Kit component.	10g
Technical Note: 1. See 15-0178 (page 67)		
15-0200	1,2-Bis(diphenylphosphino)ethane, 99% DIPHOS (1663-45-2) (C ₆ H ₅) ₂ PCH ₂ CH ₂ P(C ₆ H ₅) ₂ ; FW: 398.43; white powdr.; m.p. 143-145°	5g 25g 100g
15-0205	1,2-Bis(diphenylphosphino)ethane monooxide, min. 97% (984-43-0) (C ₆ H ₅) ₂ PCH ₂ CH ₂ P(O)(C ₆ H ₅) ₂ ; FW: 414.42; white powdr.	1g 5g
15-7306	Bis[(2-diphenylphosphino)ethyl] ammonium chloride, min. 97% (66534-97-2) C ₂₈ H ₃₀ ClNP ₂ ; FW: 477.95; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO2004096735.	500mg 2g
15-0250	cis-1,2-Bis(diphenylphosphino)ethylene, min. 98% (983-80-2) cis-(C ₆ H ₅) ₂ PCH=CHP(C ₆ H ₅) ₂ ; FW: 396.41; white xtl.; m.p. 125-126°	1g 5g
15-0383	[Bis(2-diphenylphosphino)ethyl] ether, min. 98% (50595-38-5) C ₂₈ H ₂₈ OP ₂ ; FW: 442.47; pale yellow oil <i>air sensitive</i>	1g 5g 25g
15-0350	Bis(2-diphenylphosphino-ethyl)phenylphosphine, 97% TRIPHOS (23582-02-7) (C ₆ H ₅) ₂ PCH ₂ CH ₂ P(C ₆ H ₅)CH ₂ CH ₂ P(C ₆ H ₅) ₂ ; FW: 534.56; white powdr.; m.p. 130-134°	1g 5g
26-0270	1,1'-Bis(diphenylphosphino)ferrocene, 99% DPPF (12150-46-8) (C ₆ H ₅) ₂ PC ₅ H ₄ FeC ₅ H ₄ P(C ₆ H ₅) ₂ ; FW: 554.39; yellow to orange xtl.; m.p. 180° Note: Phosphine Ligand Kit component. 1,1'-Bis(dialkyl/diarylphosphino)ferrocene Ligand Kit component.	1g 5g 25g 250g

Technical Notes:

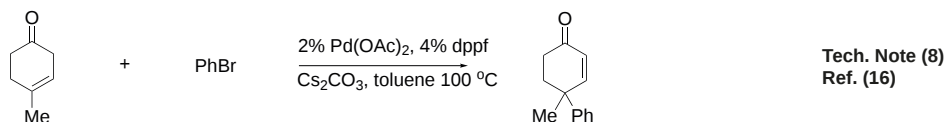
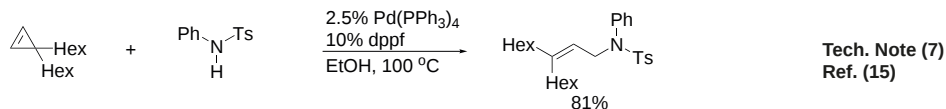
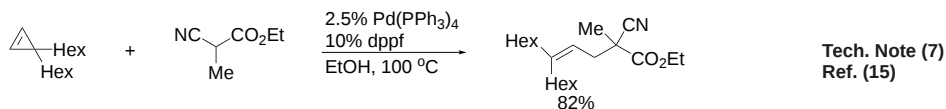
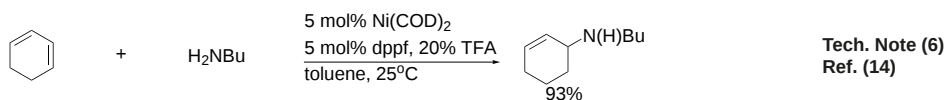
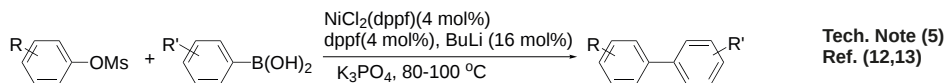
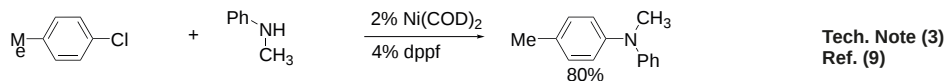
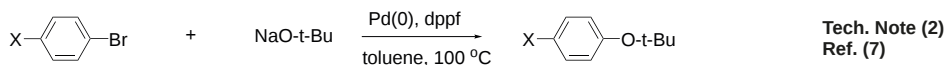
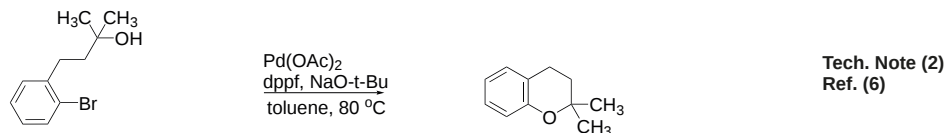
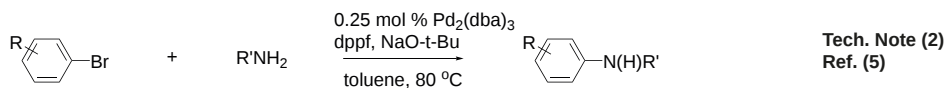
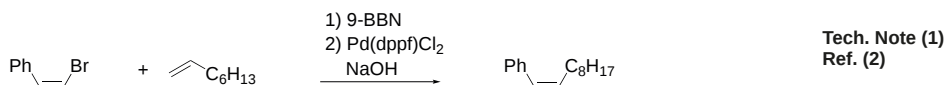
- Ligand for Pd-catalyzed cross-coupling.
- Useful ligand for Pd-catalyzed carbon-nitrogen and carbon-oxygen bond forming procedures.
- Ligand for Ni-catalyzed amination of aryl chlorides.
- Ligand for Pd-catalyzed conversion of aryl halides to aryl nitriles.
- Ligand for Ni-catalyzed Suzuki reactions.
- Ni-catalyzed hydroamination of 1,3-dienes.
- Pd-catalyzed hydrocarbonylation and hydroamination of 3,3-dihexylcyclopropene.
- Pd-catalyzed γ-arylation of β,γ-unsaturated ketones.
- Ligand for Ru-catalyzed reduction of nitriles to primary amines.
- Ligand for Rh-catalyzed alkyne head-to-tail dimerization.
- Ligand for Rh-catalyzed cross-coupling (Ref. 21).
- Ligand for Rh-catalyzed olefin isomerization (Ref. 22).
- Ligand for Ni or Rh-catalyzed borylation (Ref. 23, 24)
- Ligand for regioselective Pd-catalyzed hydrophosphinylation of terminal alkynes to form branched alkenes.



Tech. Note (1)
Ref. (1)

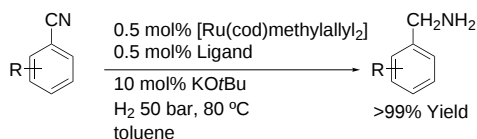
PHOSPHORUS - Ligands and Compounds

26-0270 1,1'-Bis(diphenylphosphino)ferrocene, 99% DPPF (12150-46-8)
(continued)

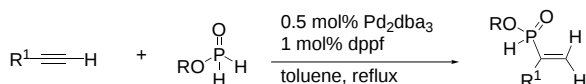


PHOSPHORUS - Ligands and Compounds

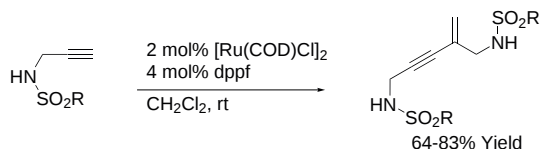
26-0270 **1,1'-Bis(diphenylphosphino)ferrocene, 99% DPPF (12150-46-8)**
(continued)



Tech. Note (9)
Ref. (18)



Tech. Note (10)
Ref. (20)

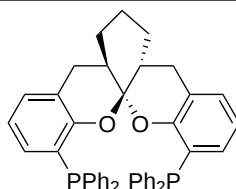


Tech. Note (14)
Ref. (25)

References:

1. *Pure Appl. Chem.*, **1980**, 52, 669.
2. *J. Am. Chem. Soc.*, **1989**, 111, 314.
3. *Palladium Reagents in Organic Synthesis* (R.F. Heck), **1985**, Chapter 6.
4. *Comprehensive Organic Synthesis*, **1991**, Vol. 3, Chapter 2.
5. *Acc. Chem. Res.*, **1998**, 31, 852. (review)
6. *J. Am. Chem. Soc.*, **1996**, 118, 10333.
7. *J. Am. Chem. Soc.*, **1996**, 118, 13109.
8. *Encyclopedia of Reagents for Organic Synthesis*, **1995**, Vol. 1, 518.
9. *J. Am. Chem. Soc.*, **1997**, 119, 6054.
10. *Tetrahedron Lett.*, **2000**, 41, 3271. (for ArCl)
11. *Tetrahedron Lett.*, **1999**, 40, 8193. (for ArBr)
12. *Tetrahedron Lett.*, **1998**, 54, 13079.
13. *J. Org. Chem.*, **1995**, 60, 1060.
14. *J. Am. Chem. Soc.*, **2002**, 124, 3669.
15. *J. Org. Chem.*, **2003**, 68, 2297.
16. *Angew. Chem. Int. Ed.*, **2008**, 47, 177.
17. *Coordination Chem. Rev.*, **2007**, 251, 2017. (review)
18. *Chem. Eur. J.*, **2008**, 14, 9491.
19. *Dalton T.*, **2009**, 36, 4926.
20. *Adv. Synth. Catal.*, **2009**, 9, 1371.
21. *J. Org. Chem.*, **2009**, 74, 2794.
22. *J. Am. Chem. Soc.*, **2009**, 131, 10822.
23. *J. Am. Chem. Soc.*, **2012**, 134, 115.
24. *J. Am. Chem. Soc.*, **2010**, 132, 1800.
25. *J. Organomet. Chem.*, **2011**, 1, 106.

15-4310 **(+)-1,13-Bis(diphenyl)phosphino-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano [3,2-d] xanthene, 97% (R,R,R)-(+)-Ph-SKP (1360823-43-3)**
C₄₄H₃₈O₂P₂; FW: 660.72; white solid;
m.p. 101-103°
air sensitive
Note: Sold in collaboration with SIOC for research purposes only. Patents PCT/CN2013/071091, CN202110253896.5. SKP Ligand Kit component.



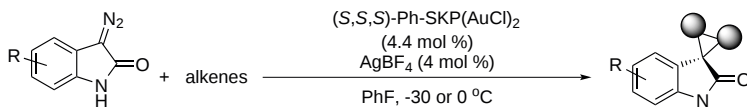
25mg
100mg

PHOSPHORUS - Ligands and Compounds

15-4310 (+)-1,13-Bis(diphenyl)phosphino-(5aR,8aR,14aR)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano [3,2-d]xanthene, 97% (R,R,R)-(+)-Ph-SKP (1360823-43-3)

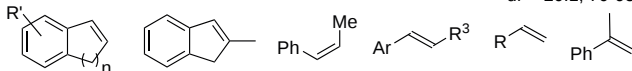
Technical Notes:

- Efficient ligand for the Au(I)-catalyzed, highly stereoselective, olefin cyclopropanation of diazooxindoles.
- Palladium-catalyzed asymmetric allylic amination of Morita-Baylis-Hillman adducts. Exceptionally high efficiency and new mechanism.
- See also 15-4320.

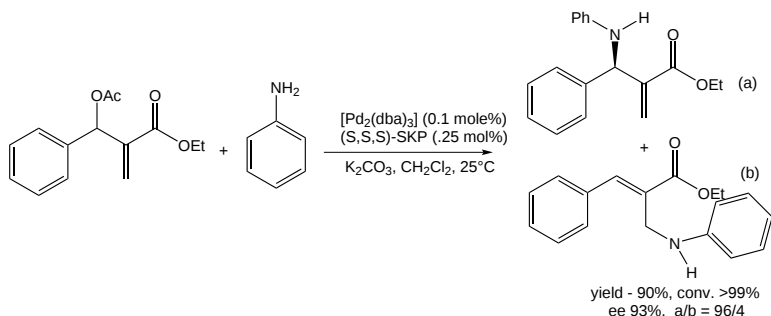


Tech. Note (1)
Ref. (1)

Alkene profiles



32 examples, 18-98% yield
dr > 20:1, 70-95% ee



Tech. Note (2)
Ref. (2)

References:

- J. Am. Chem. Soc., **2013**, 135, 8197.
- J. Am. Chem. Soc., **2014**, 136, 405.
- Angew. Chem., Int. Ed. **2012**, 51, 936.

15-4311 (-)-1,13-Bis(diphenyl)phosphino-(5aS,8aS,14aS)-5a,6,7,8,8a,9-hexahydro-5H-[1]benzopyrano [3,2-d]xanthene, 97% (S,S,S)-(-)-Ph-SKP (1439556-82-7)
C₄₄H₃₈O₂P₂; FW: 660.72; white solid; m.p. 101-103°
air sensitive
Note: Sold in collaboration with SIOC for research purposes only.
Patents PCT/CN2013/071091, CN202110253896.5. SKP Ligand Kit component.

25mg
100mg

Technical Note:

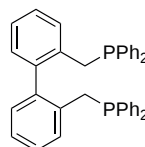
- See 15-4310 (page 70)

15-0400 Bis(diphenylphosphino)methane, 97% (2071-20-7)
(C₆H₅)₂PCH₂P(C₆H₅)₂; FW: 384.40; white xtl.; m.p. 116-119°

1g
5g
25g

15-2988 2,2'-Bis(diphenylphosphinomethyl)-1,1'-biphenyl, 99%
BISBI (111982-81-1)
C₃₈H₃₂P₂; FW: 550.61; white solid; m.p. 84-86°
air sensitive

250mg
1g

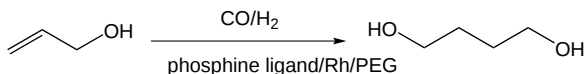


PHOSPHORUS - Ligands and Compounds

15-2988 **2,2'-Bis(diphenylphosphinomethyl)-1,1'-biphenyl, 99% BISBI (111982-81-1)**
(continued)

Technical Note:

- Ligand/rhodium complex used in the high chemo and regioselective formation of alcohols from the hydrocarbonylation of alkenes using cooperative ligand effects.

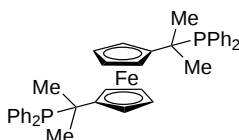


Tech. Note (1)
Ref. (1)

References:

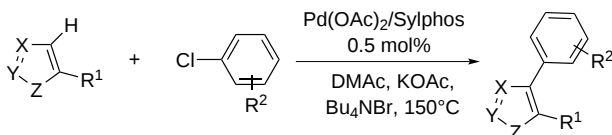
- Chem. Commun.*, **2010**, 46, 2194.

15-2970	(4R,5R)-(-)-4,5-Bis(diphenylphosphinomethyl)-2,2-dimethyl-1,3-dioxolane, 99.5% (R,R)-DIOP (32305-98-9) $C_{31}H_{32}O_2P_2$; FW: 498.55; white powdr.; m.p. 87-91° <i>air sensitive</i>	250mg 1g
15-2960	(4S,5S)-(+)-4,5-Bis(diphenylphosphinomethyl)-2,2-dimethyl-1,3-dioxolane, 99.5% (S,S)-DIOP (37002-48-5) $C_{31}H_{32}O_2P_2$; FW: 498.55; white powdr.; m.p. 87-91° <i>air sensitive</i>	250mg 1g
26-0290	1,1'-Bis(1-diphenylphosphino-1-methylethyl)ferrocene ethanol adduct, 97% HiersoPHOS-6 (Sylphos) (109313-83-9) $C_{40}H_{40}FeP_2 \cdot CH_3CH_2OH$; FW: 638.54 (684.61); orange solid	100mg 500mg



Technical Note:

- Ligand used in the palladium-catalyzed direct arylation of heteroaromatics with activated aryl chlorides.

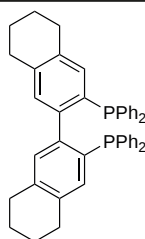
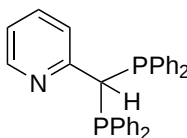


Tech. Note (1)
Ref. (1)

References:

- ACS Catalysis*, **2012**, 21, 1033

15-1779	2-[Bis(diphenylphosphino)methyl]pyridine, 98% (60398-55-2) $C_{30}H_{25}NP_2$; FW: 461.47; white powdr.	100mg 500mg
15-0502	3,3'-Bis(diphenylphosphino)-5,5',6,6',7,7',8,8'-octahydro [2,2']binaphthalene chloroform adduct, 99% (1067889-87-5) $C_{44}H_{40}P_2 \cdot 0.5CHCl_3$; FW: 630.74 (690.43); white to pale yellow powdr. Note: Sold under license from NCL for research purposes only. Patent Pending GB 0719134.9 and its international derivatives.	100mg 500mg



Technical Note:

- Ligand used in the platinum-catalyzed asymmetric carbonyl-ene reaction.

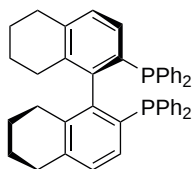
References:

- Org. Lett.*, **2007**, 9, 4925.

PHOSPHORUS - Ligands and Compounds

15-2972

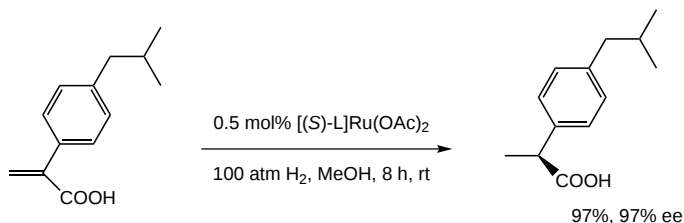
(R)-(+)-2,2'-Bis(diphenylphosphino)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl
(R)-(+)-H₈-BINAP (139139-86-9)
C₄₄H₄₀P₂; FW: 630.74; off-white powdr.;
m.p. 207-208°
Note: Manufactured under license of
Takasago patent.



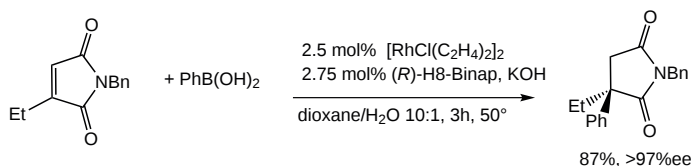
50mg
250mg

Technical Notes:

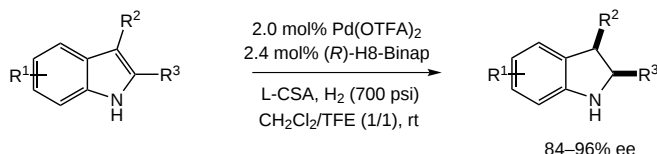
1. Biaryl bisphosphine ligand. The H8-BINAP ligand, as the ruthenium complex, catalyzes hydrogenation of unsaturated carboxylic acids to a higher ee than does BINAP. (Ref. 1,2)
2. The ruthenium catalyzed hydrogenation of aryl propenoic acid to produce the drug Ibuprofen.
3. Rhodium catalyzed asymmetric regioselective 1,4-addition of arylboronic acids to 3-substituted maleimides.
4. Ligand for palladium-catalyzed enantioselective hydrogenation of substituted indoles.
5. Rhodium-catalyzed enantioselective cyclization of γ -alkynylaldehydes with acyl phosphonates.
6. Enantioselective synthesis of axially chiral 1-arylisquinolines by Rh-catalyzed [2+2+2] cycloaddition.
7. Enantioselective synthesis of 2,3-disubstituted indolines through Bronsted acid/Pd-complex-promoted tandem reactions.
8. Dehydration triggered asymmetric hydrogenation of 3-(α -hydroxyalkyl)indoles
9. Iridium-catalyzed [2+2+2] cycloaddition of α,ω -diynes with arylisocyanates
10. Asymmetric hydrogenation of 3-(toluenesulfonamidoalkyl)-indoles
11. Asymmetric Rh(I)-catalyzed intramolecular [3+2] cycloaddition of 1-yne-vinylcyclopropanes for bicyclo[3.3.0] compounds with a chiral quaternary carbon stereocenter.
12. Enantioselective intermolecular [2+2+2] cycloadditions of ene-allenes with allenates.
13. Rh-catalyzed one-pot intermolecular [2+2+2] trimerization/asymmetric intramolecular [4+2] cycloaddition of two aryl ethynyl ethers and 5-alkynals.
14. Rh-catalyzed regio-, diastereo-, and enantioselective [2+2+2] cycloaddition of 1,6-enynes with acrylamides.



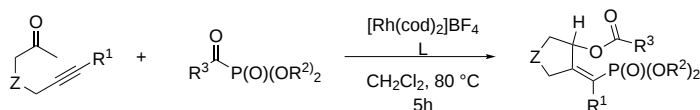
Tech. Note (1,2)
Ref. (1,2)



Tech. Note (3)
Ref. (3)



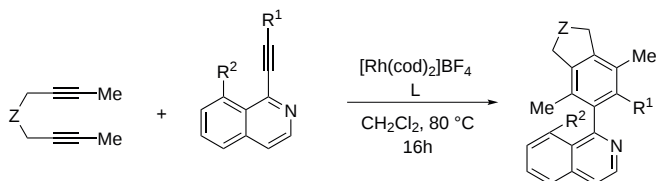
Tech. Note (4)
Ref. (4)



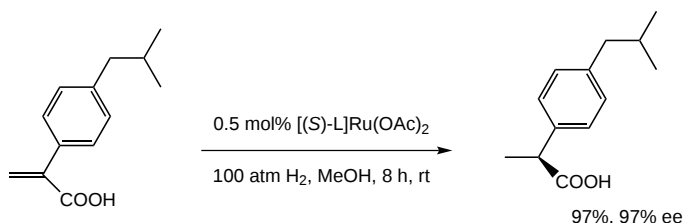
Tech. Note (5)
Ref. (5)

PHOSPHORUS - Ligands and Compounds

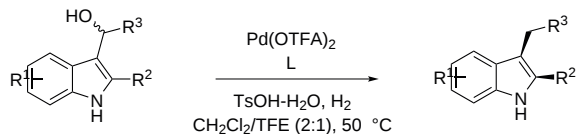
15-2972 (continued) (R)-(+)-2,2'-Bis(diphenylphosphino)- 5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl (R)-(+)-H₈-BINAP (139139-86-9)



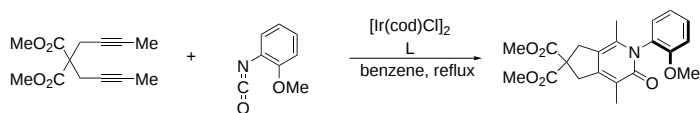
Tech. Note (6)
Ref. (6)



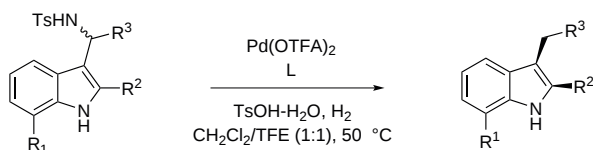
Tech. Note (7)
Ref. (7)



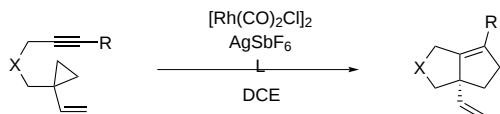
Tech. Note (8)
Ref. (8)



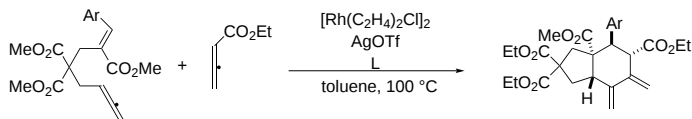
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Ref. (9)



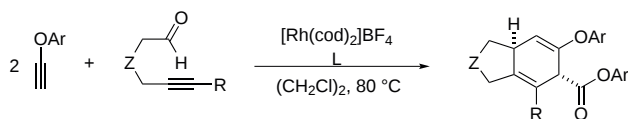
Tech. Note (10)
Ref. (10)



Tech. Note (11)
Ref. (11)



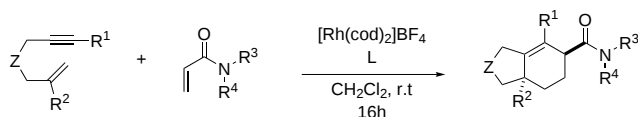
Tech. Note (12)
Ref. (12)



Tech. Note (13)
Ref. (13)

PHOSPHORUS - Ligands and Compounds

15-2972 (continued) **(R)-(+)-2,2'-Bis(diphenylphosphino)- 5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl (R)-(+)-H₈-BINAP (139139-86-9)**



Tech. Note (14)
Ref. (14)

References:

1. *J. Org. Chem.*, **1996**, 61, 5510.
2. *Topics Organometal. Chem.* **2004**, 6, 63 (review).
3. *J. Am. Chem. Soc.*, **2006**, 128, 5628.
4. *J. Am. Chem. Soc.*, **2010**, 132, 8909.
5. *J. Am. Chem. Soc.* **2011**, 133, 6918.
6. *Chem. Eur. J.* **2011**, 17, 1428.
7. *Chem. Eur. J.* **2011**, 17, 7193.
8. *Chem. Sci.*, **2011**, 2, 803.
9. *J. Org. Chem.*, **2012**, 77, 908.
10. *Org. Biomol. Chem.*, **2012**, 10, 1235.
11. *J. Am. Chem. Soc.*, **2012**, 134, 398.
12. *Org. Lett.*, **2012**, 14, 6096.
13. *Org. Lett.*, **2012**, 14, 5856.
14. *Angew. Chem. Int. Ed.*, **2012**, 51, 13031.

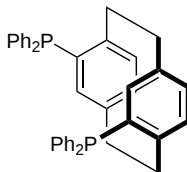
15-2973	(S)-(-)-2,2'-Bis(diphenylphosphino)-5,5',6,6',7,7',8,8'-octahydro- 1,1'-binaphthyl (S)-(-)-H₈-BINAP (139139-93-8)	50mg 250mg
	C ₄₄ H ₄₀ P ₂ ; FW: 630.74; off-white powdr.; m.p. 207-208°	
	Note: Manufactured under license of Takasago patent.	

Technical Note:

1. See 15-2972 (page 73)

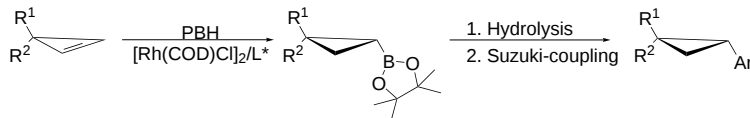
15-0420	1,8-Bis(diphenylphosphino)octane, 99% (41625-30-3)	1g 5g
	C ₃₂ H ₃₆ P ₂ ; FW: 482.58; white powdr.	

15-0425	(R)-(-)-4,12-Bis(diphenylphosphino)-[2.2]-paracyclophane, min. 95% (R)-PHANEPHOS (364732-88-7)	100mg 500mg
	C ₄₀ H ₃₄ P ₂ ; FW: 576.65; white solid; m.p. 222-225°	
	Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent Application No 5874629 and patents arising therefrom.	

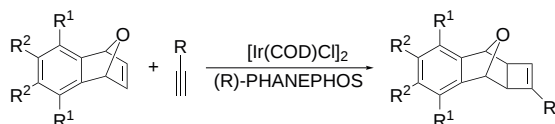


Technical Notes:

1. Ligand for rhodium-catalyzed enantioselective hydroboration of cyclopropenes.
2. Ligand for iridium-catalyzed enantioselective [2+2] cycloaddition of oxabicyclic alkenes with terminal alkynes.
3. Ligand for the palladium-catalyzed enantioselective hydroxycarbonylation and alkoxy carbonylation of alkenes.
4. Ligand for the palladium-catalyzed amides synthesis via C(sp³)-H bond functionalization and CO insertion.
5. Ligand for iridium-catalyzed diene hydrohydroxymethylation.



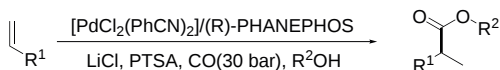
Tech. Note (1)
Ref. (1)



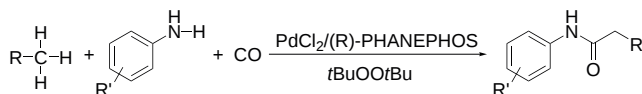
Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

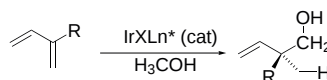
15-0425 (continued) **(R)-(-)-4,12-Bis(diphenylphosphino)-[2.2]-paracyclophane, min. 95% (R)-PHANEPHOS (364732-88-7)**



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

References:

1. *J. Am. Chem. Soc.*, **2003**, 125, 7198.
2. *Org. Lett.*, **2010**, 12, 304.
3. *Angew. Chem. Int. Ed.*, **2010**, 49, 9197.
4. *Chem. Commun.*, **2014**, 50, 341.

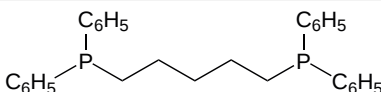
15-0426 (S)-(+)-4,12-Bis(diphenylphosphino)-[2.2]-paracyclophane, min. 95% (S)-PHANEPHOS (192463-40-4)
C₄₀H₃₄P₂; FW: 576.65; white solid; m.p. 222-225°
Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent Application No 5874629 and patents arising therefrom.

100mg
500mg

Technical Note:

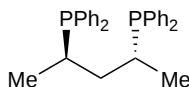
1. See 15-0425 (page 75)

15-0430 1,5-Bis(diphenylphosphino) pentane, min. 98% (27721-02-4)
(C₆H₅)₂P(CH₂)₅P(C₆H₅)₂;
FW: 440.51; white to off-white solid; m.p. 46-49°



1g
5g

15-0432 (2R,4R)-(+)-2,4-Bis(diphenylphosphino) pentane, 99% (R,R)-BDPP (96183-46-9)
(C₆H₅)₂PCH(CH₃)CH₂CH(CH₃)P(C₆H₅)₂;
FW: 440.49; white xtl.; m.p. 78°
air sensitive

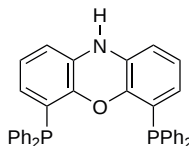


500mg
2g

15-0431 (2S,4S)-(-)-2,4-Bis(diphenylphosphino)pentane, 99% (S,S)-BDPP (77876-39-2)
(C₆H₅)₂PCH(CH₃)CH₂CH(CH₃)P(C₆H₅)₂; FW: 440.49; white xtl.; m.p. 81°
air sensitive

250mg
1g
5g

15-0437 4,6-Bis(diphenylphosphino) phenoxazine, min. 98% NIXANTPHOS (261733-18-0)
C₃₆H₂₇NOP₂; FW: 551.55; white to off-white powdr.



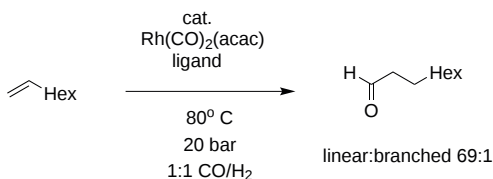
500mg
2g

Technical Notes:

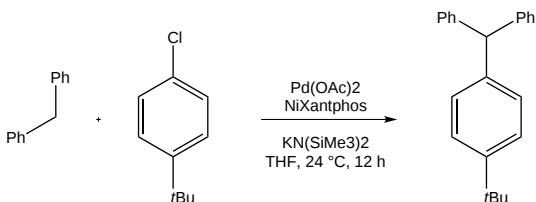
1. A large bite-angle chelating bisphosphine that provides high levels of linear-to-branched selectivity in the hydroformylation of alkenes
2. A Deprotonatable Ligand for Room-Temperature Palladium-Catalyzed Cross-Couplings of Aryl Chlorides.

PHOSPHORUS - Ligands and Compounds

15-0437 4,6-Bis(diphenylphosphino) phenoxazine, min. 98% NIXANTPHOS (261733-18-0)
(continued)



Tech. Note (1)
Ref. (1)

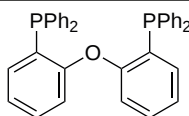


Tech. Note (2)
Ref. (2)

References:

1. *Organometallics*, **2000**, 19, 872.
2. *J. Am. Chem. Soc.*, **2014**, 136, 6276.

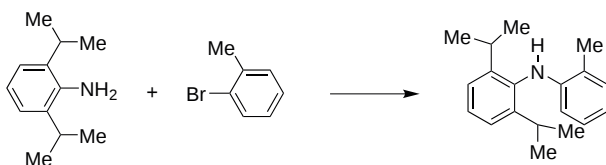
15-0380 Bis(2-diphenylphosphinophenyl)ether, 98% DPEphos (166330-10-5)
(C₆H₅)₂PC₆H₄OC₆H₄P(C₆H₅)₂; FW: 538.56;
off-white powdr.; m.p. 181-184°
Note: Phosphine Ligand Kit component.



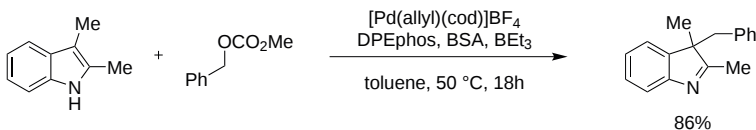
5g
25g
100g

Technical Notes:

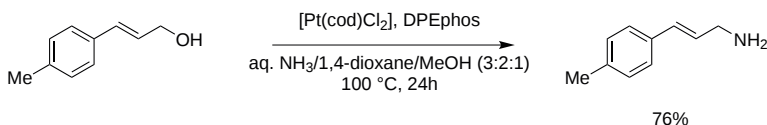
1. Useful as a ligand in the Pd-catalyzed formation of diaryl amines.
2. Has been recently applied to the C3 benzylation of indoles.
3. Has been recently applied to the monoallylation of ammonia.
4. Ligand used in the palladium-catalyzed, aerobic oxidation coupling of acyl chlorides with arylboronic acids.
5. Ligand used in carbonylation of aryl iodides.
6. Ligand used in the direct C-H arylation of benzothiadiazoles.
7. Ligand used in stereo-retentive azacyclization of propargylic carbonates.
8. Ligand used in palladium catalyzed benzyne trimerization.



Tech. Note (1)
Ref. (1)



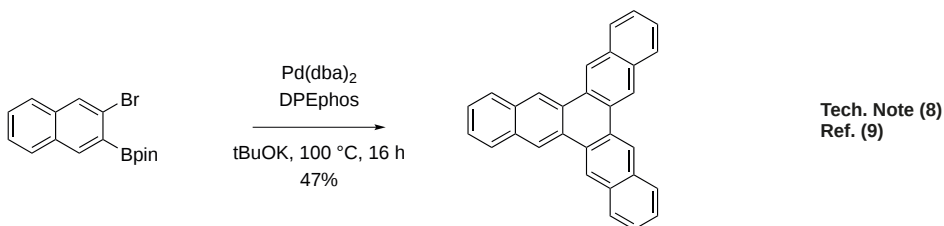
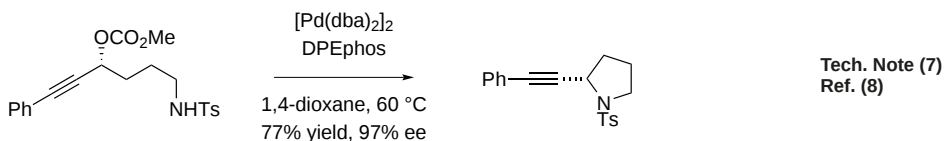
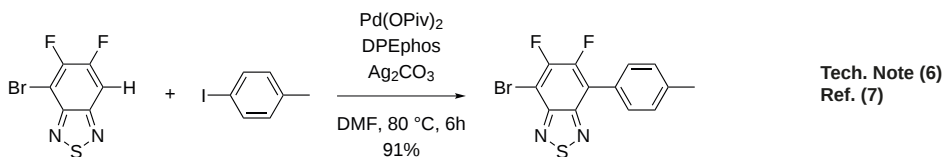
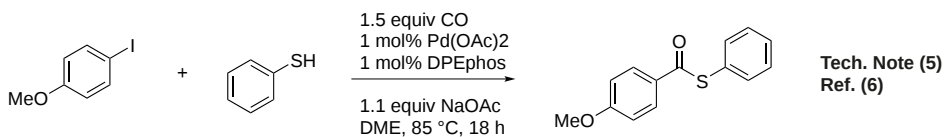
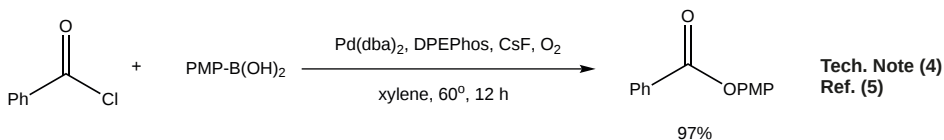
Tech. Note (2)
Ref. (3)



Tech. Note (3)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

15-0380 Bis(2-diphenylphosphinophenyl)ether, 98% DPEphos (166330-10-5)
(continued)



References:

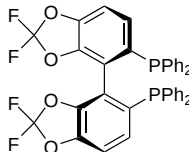
1. *Tetrahedron Lett.*, **1998**, 39, 5327.
2. *Organometallics*, **1995**, 14, 3081.
3. *J. Am. Chem. Soc.*, **2012**, 134, 111.
4. *Angew. Chem. Int. Ed.*, **2012**, 51, 150.
5. *Adv. Synth. Catal.*, **2012**, 354(11), 2117.
6. *Org. Lett.*, **2013**, 15, 948.
7. *J. Org. Chem.*, **2014**, 79, 1712.
8. *Angew. Chem. Int. Ed.*, **2014**, 53, 1915.
9. *Org. Lett.*, **2014**, 16, 1338.

15-0450	1,3-Bis(diphenylphosphino)propane, 98% DPPP (6737-42-4) (C ₆ H ₅) ₂ PCH ₂ CH ₂ CH ₂ P(C ₆ H ₅) ₂ ; FW: 412.45; white xtl.; m.p. 60-63°	10g
		50g
15-0440	R-(+)-1,2-Bis(diphenylphosphino)propane, 99% (R)-PROPHOS (67884-32-6) (C ₆ H ₅) ₂ PCH(CH ₃)CH ₂ P(C ₆ H ₅) ₂ ; FW: 412.45; white xtl.; m.p. 69-71° (sealed tube) <i>air sensitive</i>	250mg
		1g

PHOSPHORUS - Ligands and Compounds

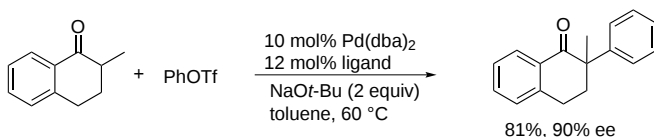
15-0449 **1,3-Bis(diphenylphosphino)propane monooxide, min. 97%** 1g
(85685-99-0) 5g
(C₆H₅)₂PCH₂CH₂CH₂P(O)(C₆H₅)₂; FW: 428.44; white powdr.

15-0486 **R-(-)-5,5'-Bis(diphenylphosphino)-2,2,2',2'-tetrafluoro-4,4'-bi-1,3-benzodioxole, dichloromethane adduct, min. 97% (R)-DIFLUORPHOS™ (503538-69-0)** 100mg
C₃₈H₂₄F₄O₄P₂·XCH₂Cl₂; FW: 682.54; white powdr. 500mg
air sensitive
Note: Sold under license from SYNKEM for research purposes only-not for drug use.
Patent application WO 03/029259. US
Patent No. 6.878.665 B2. For directions of use and safety see SDS available at www.strem.com. Optical purity: 99.5+%

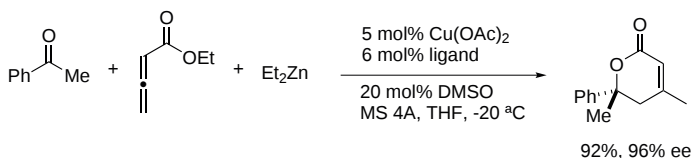


Technical Notes:

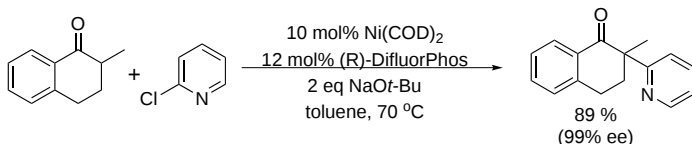
1. Ligand used for the enantioselective hydrogenation of olefins, and especially electron-poor ketones.
2. Ligand used for the enantioselective α -arylation of ketones.
3. Ligand used for enantioselective alkylative aldol reactions.
4. Nickel-catalyzed asymmetric α -heteroarylation of ketones with chloroarenes.
5. Palladium-catalyzed asymmetric intramolecular arylation of α -keto amides.
6. Ligand for Iridium-catalyzed asymmetric hydrogenation of pyridinium salts.
7. Ligand for Hg(II)-Catalyzed Cyclopropanation of Diazooxindoles and Alkenes.
8. Ligand for Rhodium-Catalyzed Asymmetric 1,4-Addition Reactions.



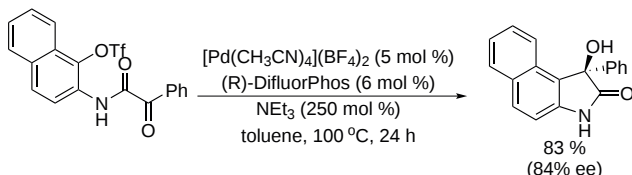
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



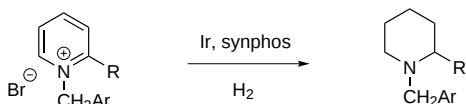
Tech. Note (4)
Ref. (4)



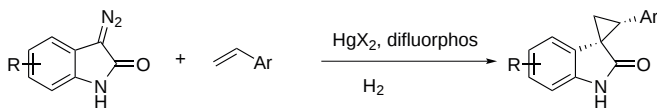
Tech. Note (5)
Ref. (5)

PHOSPHORUS - Ligands and Compounds

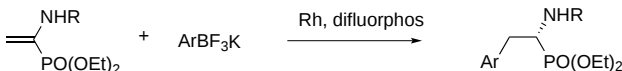
15-0486 **R-(-)-5,5'-Bis(diphenylphosphino)-2,2',2'-tetrafluoro-4,4'-bi-1,3-benzodioxole, dichloromethane adduct, min. 97% (R)-DIFLUORPHOS™ (503538-69-0)**



Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)



Tech. Note (8)
Ref. (8)

References:

1. *Angew. Chem. Int. Ed.*, **2004**, 43, 320.
2. *J. Am. Chem. Soc.*, **2008**, 130, 195.
3. *J. Am. Chem. Soc.*, **2007**, 129, 7439.
4. *J. Am. Chem. Soc.*, **2011**, 133, 16330.
5. *Angew. Chem. Int. Ed.*, **2011**, 50, 7620.
6. *Angew. Chem. Int. Ed.*, **2012**, 51, 10181.
7. *Organic Letters*, **2013**, 15, 42.
8. *Organic Letters*, **2013**, 15, 4274.

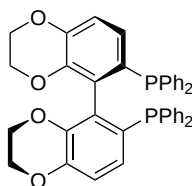
15-0487 **S-(+)-5,5'-Bis(diphenylphosphino)-2,2',2'-tetrafluoro-4,4'-bi-1,3-benzodioxole, dichloromethane adduct, min. 97% (S)-DIFLUORPHOS™ (503538-70-3)**
C₃₈H₂₄F₄O₄P₂·XCH₂Cl₂; FW: 682.54; white powdr.
air sensitive
Note: Sold under license from SYNKEM for research purposes only-not for drug use. Patent application WO 03/029259. US Patent No. 6.878.665 B2. For directions of use and safety see SDS sheet available at www.strem.com. Optical purity: 99.5+%

100mg
500mg

Technical Note:

1. See 15-0486 (page 79)

15-0490 **R-(+)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 94% (R)-SYNPHOS™ (445467-61-8)**
C₄₀H₃₂O₄P₂; FW: 638.63; white powdr.
Note: Sold under license from SYNKEM for research purposes only - not for drug use. Patent application WO 03/029259. US Patent No. 6.878.665 B2. For directions of use and safety see SDS sheet available at www.strem.com



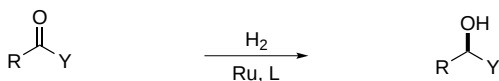
100mg
500mg

Technical Notes:

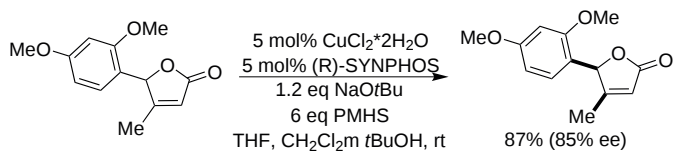
1. A chiral diphosphine ligand used in the highly-enantioselective hydrogenation of ketoesters, hydroxyketones, ketophosphonates and succinates.
2. A ligand used for the dynamic kinetic resolution of α,β -unsaturated lactones via asymmetric copper-catalyzed conjugate reduction.
3. Used in the intramolecular Heck reaction for the synthesis of diterpenoids.
4. Used in asymmetric Pauson-Khand reaction.
5. Used in asymmetric iminonitroso Diels-Alder reaction.
6. Palladium catalyzed asymmetric hydrogenation of N-tosyl ketimines.
7. Ligand for asymmetric hydroalkynylation of norbornadienes

PHOSPHORUS - Ligands and Compounds

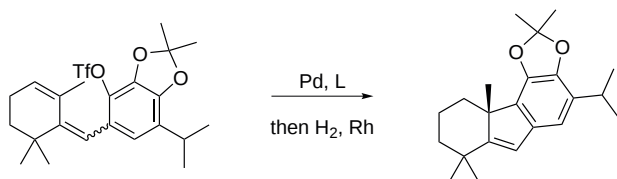
15-0490 R-(+)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 94%
(continued) (R)-SYNPHOS™ (445467-61-8)



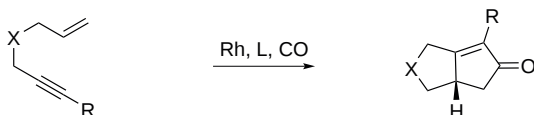
Tech. Note (1)
Ref. (1)



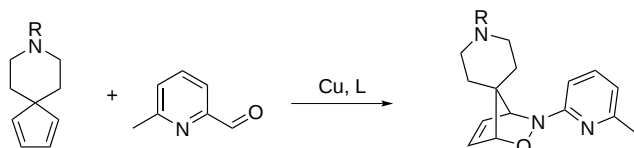
Tech. Note (2)
Ref. (2)



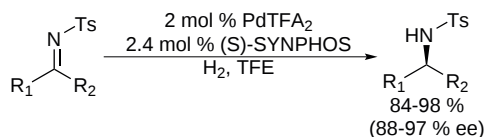
Tech. Note (3)
Ref. (3)



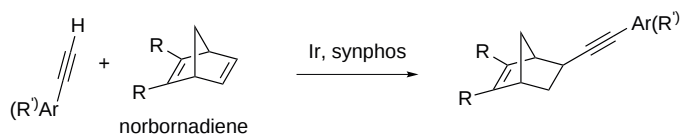
Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)

References:

1. *Tetrahedron Lett.*, **2003**, 44, 823.
2. *Angew. Chem. Int. Ed.*, **2005**, 44, 6177.
3. *J. Org. Chem.*, **2010**, 75, 190.
4. *Adv. Synth. Catal.*, **2007**, 349, 1999.
5. *Tetrahedron Lett.*, **2009**, 50, 5879.
6. *J. Org. Chem.*, **2007**, 72, 3729.
7. *Angew. Chem. Int. Ed.*, **2012**, 51, 7821.

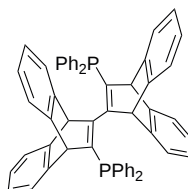
PHOSPHORUS - Ligands and Compounds

15-0491	S-(-)-6,6'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-5,5'-bi-1,4-benzodioxin, min. 97% (S)-SYNPHOS™ (503538-68-9) C ₄₀ H ₃₂ O ₂ P ₂ ; FW: 638.63; white powdr. Note: Sold under license from SYNKEM for research purposes only - not for drug use. Patent application WO 03/029259. US Patent No. 6,878,665 B2. For directions of use and safety see SDS sheet available at www.strem.com	100mg
		500mg

Technical Note:

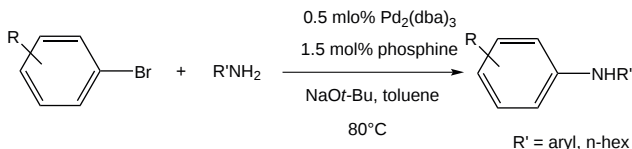
1. See 15-0490 (page 80)

15-0442	12,12'-Bis(diphenylphosphino)-9,9',10,10'-tetrahydro-11,11'-bi-9,10-ethenoanthracene, min. 98% CATPHOS (1020670-88-5) C ₅₆ H ₄₀ P ₂ ; FW: 774.86; white xtl.	250mg
		1g

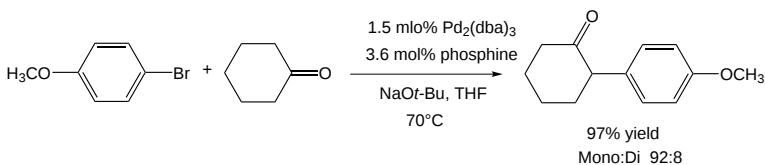


Technical Notes:

1. Useful ligand for the palladium-catalyzed amination reaction, notably with sterically demanding and electron-rich substrates.
2. Useful ligand for the palladium-catalyzed α -arylation of ketones.



Tech. Note (1)
Ref. (1)

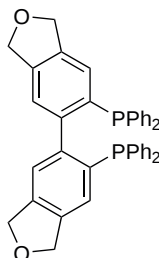


Tech. Note (2)
Ref. (1)

References:

1. *Organometallics*, **2008**, 27, 1679.

15-0504	6,6'-Bis(diphenylphosphino)-1,1',3,3'-tetrahydro[5,5']biisobenzofuran, 99% (959864-38-1) C ₄₀ H ₃₂ O ₂ P ₂ ; FW: 606.63; white to off-white powdr. Note: Sold under license from NCL for research purposes only. Patent Pending GB 0719134.9 and its international derivatives.	100mg
		500mg



Technical Note:

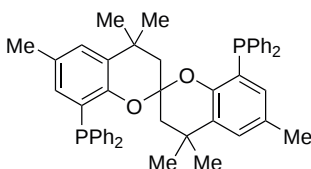
1. Ligand used in the platinum-catalyzed asymmetric carbonyl-ene reaction.

References:

1. *Org. Lett.*, **2007**, 9, 4925.

PHOSPHORUS - Ligands and Compounds

15-5165 racemic-8,8'-Bis(diphenylphosphino)-3,3',4,4'-tetrahydro-4,4',4',6,6'-hexamethyl-2,2'-spirobi[2H-1-benzopyran], min. 95% SPANphos (556797-94-5)
C₄₇H₄₆O₂P₂; FW: 704.81; white powder.



100mg
500mg

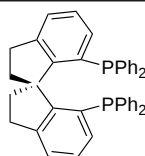
Technical Note:

1. A binucleating diphosphine ligand used as a trans-spanning ligand which rigidly links mutually trans coordination sites via phosphorous atoms separated by a large distance to form a cavity over the face of square planar mono and di-metallic complexes, e.g. in MCl₂(SPANphos) (M = Pd, Pt), Rh₂(μ-Cl)₂(CO)₂(SPANphos), the latter useful in, for example, the homogeneous catalytic carbonylation of methanol to acetic acid.

References:

1. *Angew. Chem. Int. Ed.*, **2003**, 42, 1284.
2. *Angew. Chem. Int. Ed.*, **2005**, 44, 4385.

15-5174 (R)-(+)-7,7'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (R)-SDP (917377-74-3)
C₄₁H₃₄P₂; FW: 588.66; white solid; m.p. 200-202°
air sensitive
Note: Spiro Bisphosphine Ligand Kit component.



25mg
100mg

Technical Notes:

1. Ligands used for the ruthenium-catalyzed hydrogenation of simple and cyclic ketones with high activity and enantioselectivity.
2. Ligands used for palladium-catalyzed asymmetric allylic alkylations.

References:

1. *J. Am. Chem. Soc.*, **2003**, 125, 4404.
2. *J. Org. Chem.*, **2005**, 70, 2967.
3. *Adv. Synth. Catal.*, **2004**, 346, 625.

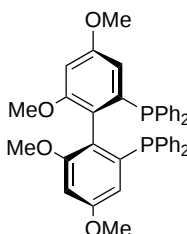
15-5175 (S)-(-)-7,7'-Bis(diphenylphosphino)-2,2',3,3'-tetrahydro-1,1'-spirobiindane, min. 97% (S)-SDP (528521-86-0)
C₄₁H₃₄P₂; FW: 588.66; white solid; m.p. 206-208°
air sensitive
Note: Spiro Bisphosphine Ligand Kit component.

25mg
100mg

Technical Note:

1. See 15-5174 (page 83)

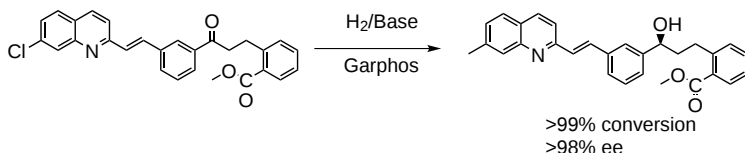
15-1653 (R)-2,2'-Bis(diphenylphosphino)-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-Ph-Garphos™ (1365531-75-4)
C₄₀H₃₆O₄P₂; FW: 642.66; white xtl.
air sensitive
Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.



100mg
500mg

Technical Note:

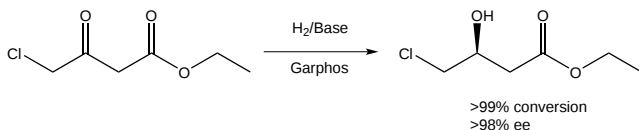
1. Chiral ligand used in the preparation of hydrogenation catalysts with exceptionally high activity and selectivity.



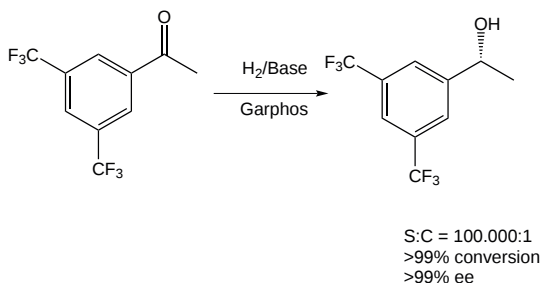
Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-1653 (continued) **(R)-2,2'-Bis(diphenylphosphino)-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-Ph-Garphos™ (1365531-75-4)**



Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (1)

References:

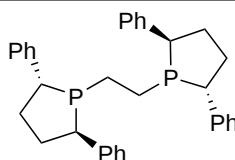
- US Patent Application No. 61/381,493.

15-1654	(S)-2,2'-Bis(diphenylphosphino)-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (S)-Ph-Garphos™ (1365531-76-5)	100mg
	$C_{40}H_{36}O_4P_2$; FW: 642.66; white xtl.	500mg
	<i>air sensitive</i>	
	Note: Sold in collaboration with KCT. Patent US App No. 61/381,493.	
	Garphos™ Ligand Kit component.	

Technical Note:

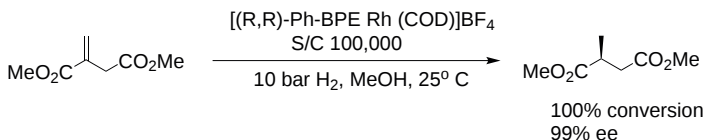
- See 15-1653 (page 83)

15-0473	(-)-1,2-Bis((2R,5R)-2,5-di-phenylphospholano)ethane, min. 95% (R,R)-Ph-BPE (528565-79-9)	100mg
	$(C_{16}H_{16})PCH_2CH_2P(C_{16}H_{16})$; FW: 506.60;	500mg
	white solid; m.p. 144°	2g
	<i>air sensitive</i>	



Technical Notes:

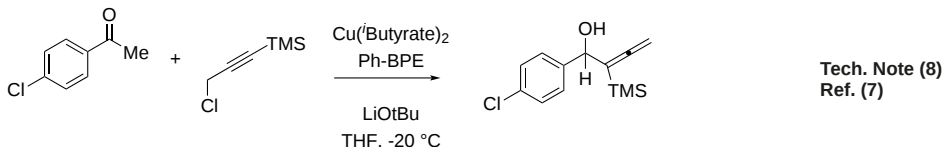
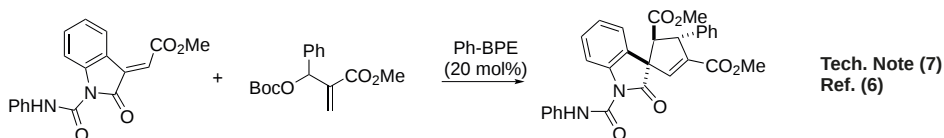
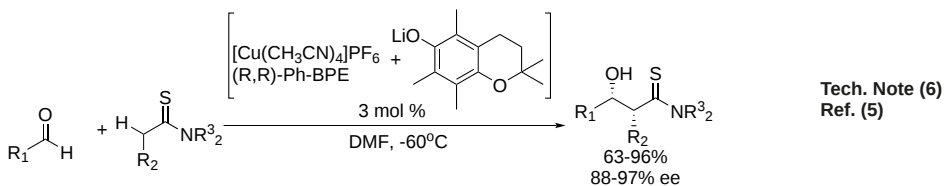
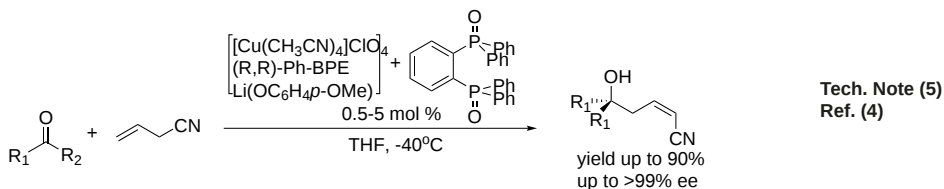
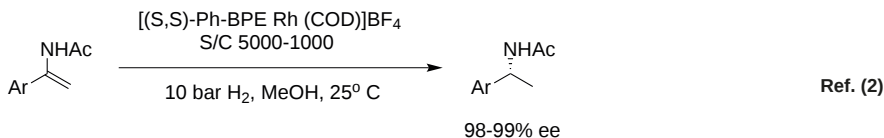
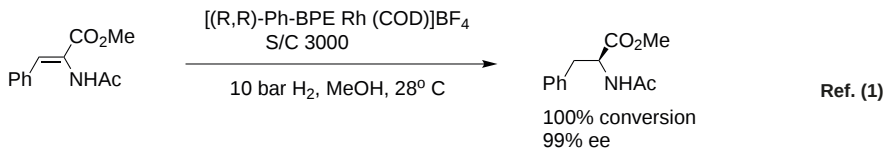
- Phenyl-BPE exhibits enhanced activity and selectivity over existing members of the BPE ligand family in rhodium catalysed asymmetric hydrogenation.
- This ligand is highly efficient for the hydrogenation of N-acyl aryl-enamides.
- Molar substrate/catalyst ratios of up to 100,000/1 are achieved with excellent reactivity and enantioselectivity using commercial grade substrates and solvents.
- Ligand in the rhodium-catalyzed asymmetric hydroformylation of olefins.
- Ligand for asymmetric addition of allyl cyanide to ketones.
- Ligand for catalytic enantio- and diastereoselective aldol reaction of thioamides.
- Organocatalytic 3+2 cycloaddition.
- Site selective allenylation.
- Asymmetric Phosphonate addition.
- Hydroboration of enamines



Ref. (1)

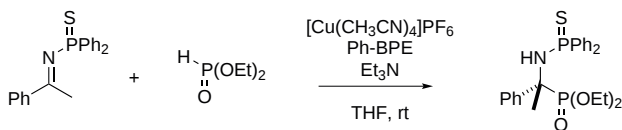
PHOSPHORUS - Ligands and Compounds

15-0473 (continued) (-)-1,2-Bis((2R,5R)-2,5-diphenylphospholano)ethane, min. 95% (R,R)-Ph-BPE (528565-79-9)

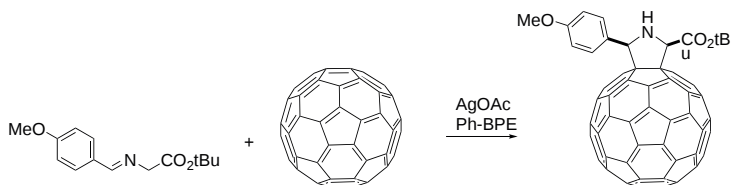


PHOSPHORUS - Ligands and Compounds

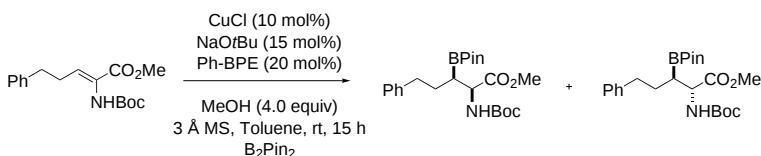
15-0473 (-)-1,2-Bis((2R,5R)-2,5-diphenylphospholano)ethane, min. 95% (R,R)-Ph-BPE (528565-79-9)
(continued)



Tech. Note (9)
Ref. (8)



Tech. Note (10)
Ref. (9)



Tech. Note (11)
Ref. (10)

References:

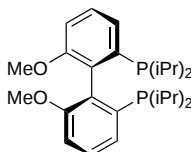
1. *Org. Lett.*, **2003**, 5, 1273.
2. *Tetrahedron Lett.*, **2004**, 45, 9277
3. *Angew. Chem. Int. Ed.*, **2005**, 44, 5834.
4. *J. Am. Chem. Soc.*, **2010**, 132, 5522.
5. *J. Am. Chem. Soc.*, **2011**, 133, 5554.
6. *J. Am. Chem. Soc.*, **2011**, 133, 4672.
7. *Org. Lett.*, **2013**, 15, 1214.
8. *J. Am. Chem. Soc.*, **2013**, 135, 10338.
9. *J. Am. Chem. Soc.*, **2014**, 136, 705.
10. *Org. Lett.*, **2014**, 16, 1426.

15-0474	(+)-1,2-Bis((2S,5S)-2,5-diphenylphospholano)ethane, min. 98%	100mg
	(S,S)-Ph-BPE (824395-67-7)	500mg
	(C ₁₆ H ₁₆)PCH ₂ CH ₂ P(C ₁₆ H ₁₆); FW: 506.60; white solid; m.p. 144°	2g
	<i>air sensitive</i>	

Technical Note:

1. See 15-0473 (page 84)

15-0448	Bis(di-<i>i</i>-propylamino)chlorophosphine, min. 97% (56183-63-2)	5g
HAZ	[(C ₃ H ₇) ₂ N] ₂ PCl; FW: 266.80; white to off-white powdr.	25g
	<i>air sensitive, moisture sensitive</i>	
15-0650	1,4-Bis(di-<i>i</i>-propylphosphino)butane, min. 98% (80499-19-0)	100mg
amp	(C ₃ H ₇) ₂ PCH ₂ CH ₂ CH ₂ CH ₂ P(C ₃ H ₇) ₂ ; FW: 290.41; colorless to pale yellow liq.	500mg
HAZ	<i>air sensitive</i>	
15-0654	(R)-(+)-2,2'-Bis(di-<i>i</i>-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (150971-45-2)	100mg
	C ₂₈ H ₄₀ O ₂ P ₂ ; FW: 446.56; white powdr.	500mg
	Note: Sold in collaboration with Solvias for research purposes only. Solvias (R)-MeO BIPHEP Ligand Kit component.	2g
		10g



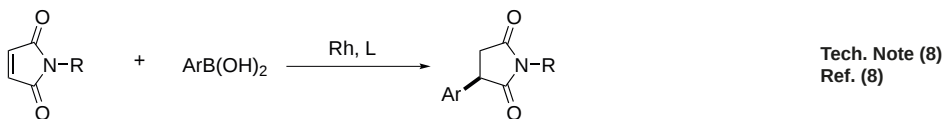
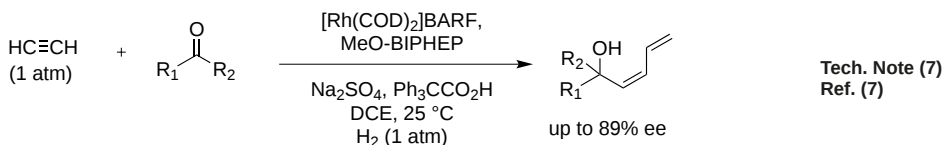
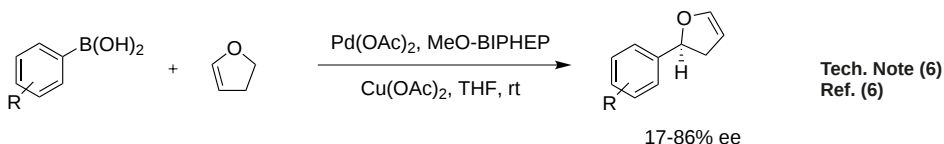
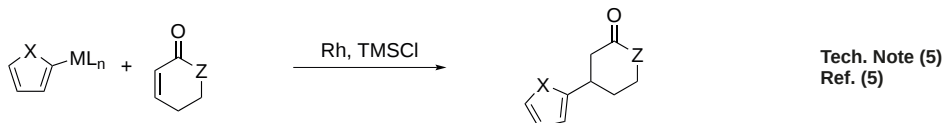
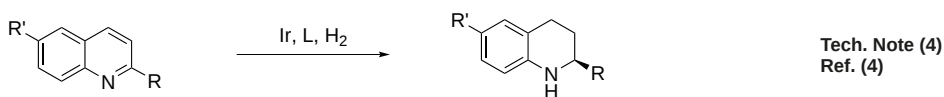
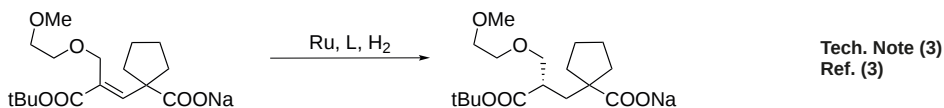
In many respects the catalytic profile of the MeOBIPHEP ligands is similar to that of other atropisomeric diphosphines such as binap and its many analogs. The nature of the PR2 group strongly influences the catalytic performance of the metal complexes. The rhodium and ruthenium MeO-BIPHEP catalysts are highly effective for the hydrogenation of various C=O, C=C and C=N bonds and several synthetically useful C-C coupling reactions.

PHOSPHORUS - Ligands and Compounds

15-0654 (R)-(+)-2,2'-Bis(di-*i*-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97%
(continued) (150971-45-2)

Technical Notes:

1. See 15-0042.
2. Ru and Ir catalyzed dynamic kinetic resolution for the synthesis of hydroxy, amino acid derivatives.
3. Ru-catalyzed asymmetric hydrogenation of ketones and alkenes.
4. Ir catalyzed enantioselective hydrogenation of heteroaromatic compounds.
5. Conjugate addition using 2-heteroaryl titanates and zinc reagents.
6. Enantio- and regioselective heck-type reaction of aryl boronic acids with 2,3-dihydrofuran
7. Rhodium-catalyzed carbonyl Z-dienylation.
8. Rhodium-catalyzed asymmetric 1,4 addition of arylboronic acids to maleimides and enones.



References:

1. *Adv. Synth. Catal.*, **2004**, 346, 842.
2. *Org. Lett.*, **2006**, 8, 4573.
3. *Org. Process Res. Devel.*, **2001**, 5, 438.
4. *J. Am. Chem. Soc.*, **2003**, 125, 10536.
5. *Org. Lett.*, **2009**, 11, 4200.
6. *J. Org. Chem.*, **2007**, 72, 3875.
7. *J. Am. Chem. Soc.*, **2006**, 128, 16040.
8. *J. Org. Chem.*, **2011**, 76, 6925.

PHOSPHORUS - Ligands and Compounds

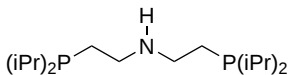
15-0655	(S)-(-)-2,2'-Bis(di-<i>i</i>-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (150971-43-0)	100mg 500mg 2g 10g
	$C_{26}H_{40}O_2P_2$; FW: 446.56; white powdr. Note: Sold in collaboration with Solvias for research purposes only. Solvias (S)-MeO BIPHEP Ligand Kit component.	

Technical Note:

1. See 15-0654 (page 86)

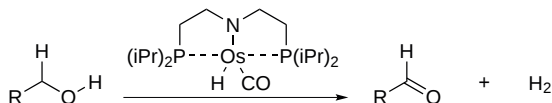
15-0610	1,2-Bis(di-<i>i</i>-propylphosphino)ethane, 98% (87532-69-2)	100mg 500mg
amp HAZ	$C_{14}H_{32}P_2$; FW: 262.35; colorless to pale yellow liq. <i>air sensitive</i>	

15-7304	Bis[(2-di-<i>i</i>-propylphosphino)ethyl] amine, min. 97% (10 wt% in tetrahydrofuran) (131890-26-1)	5g 20g
HAZ	$C_{16}H_{37}NP_2$; FW: 305.42; pale yellow to colorless liq. <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO2004096735.	

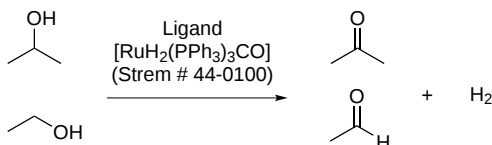


Technical Notes:

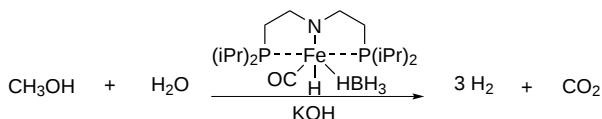
1. Ligand for the osmium dehydrogenation of alcohols
2. Ligand for the ruthenium dehydrogenation of alcohols
3. Ligand for the iron catalyzed production of hydrogen from methanol
4. Ligand for the iron catalyzed hydrogenation of esters to alcohols



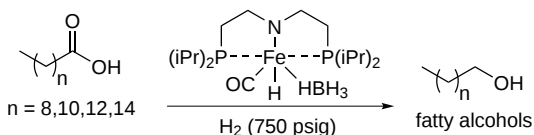
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

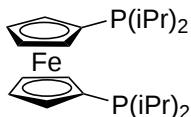
References:

1. *Organometallics*, **2011**, 30, 3479
2. *Angew. Chem. Int. Ed.*, **2011**, 50, 9593
3. *Angew. Chem. Int. Ed.*, **2013**, 50, 14162
4. *J. Am. Chem. Soc.*, **2014**, 136, 7869

PHOSPHORUS - Ligands and Compounds

26-0275

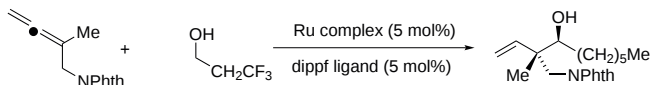
1,1'-Bis(di-i-propylphosphino)ferrocene,
min. 98% DiPPF (97239-80-0)
 $[(C_3H_7)_2PC_5H_4]_2Fe$; FW: 418.33;
 orange-yellow powdr.
 Note: 1,1'-Bis(dialkyl/diarylphosphino)
 ferrocene Ligand Kit component.



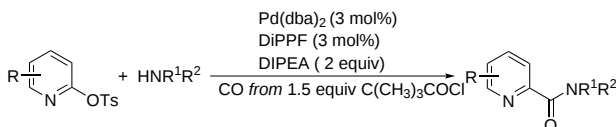
500mg
 2g
 10g

Technical Notes:

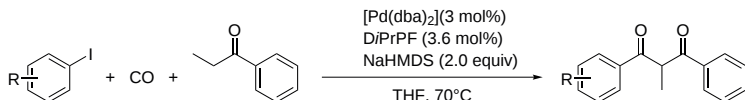
1. Ruthenium- catalyzed hydrohydroxyalkylation of 1,1-disubstituted allenes
2. Ligand for palladium-catalyzed aminocarbonylation of Pyridyl Tosylates by means of ex situ generation of CO.
3. Pd-catalyzed carbonylative α -arylation of ketones with aryl iodides
4. Ligand for palladium-catalyzed alkoxy carbonylation of aryl bromides for the preparation of tertiary esters
5. Ligand for stereoselective palladium-catalyzed decarboxylative allylation β -C-glycosylation
6. Ligand for ruthenium-catalyzed C—C coupling reactions of fluorinated alcohols with allenes.
7. Ligand for cobalt-catalyzed intermolecular formal hydroacylation reaction of olefins using N-3-picolin-2-yl aldimines as aldehyde equivalents.



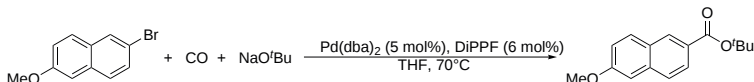
Tech. Note (1)
Ref. (2)



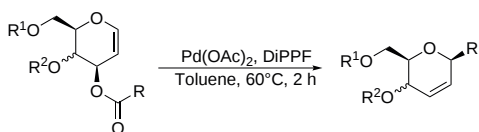
Tech. Note (2)
Ref. (2)



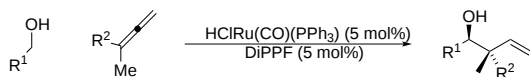
Tech. Note (2)
Ref. (3)



Tech. Note (2)
Ref. (4)

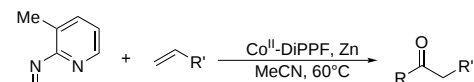


Tech. Note (3)
Ref. (5)



$R^1 = CH_2F, CH_2CF_3, (CH_2)_2CF_3, HC=CHCF_3$
 $R^2 = Ph, CH_2NPhth, 4-MeOC_6H_4, 3,5-Cl_2C_6H_3$

Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)

References:

1. *J. Am. Chem. Soc.* **2011**, 133, 1141
2. *J. Am. Chem. Soc.* **2011**, 133, 6061
3. *Angew. Chem. Int. Ed.* **2012**, 51, 798
4. *Org. Lett.*, **2012**, 14, 284
5. *Angew. Chem. Int. Ed.* **2013**, 52, 5134
6. *Angew. Chem. Int. Ed.* **2015**, 54, 5465
7. *ACS Catal.* **2015**, 5, 3054

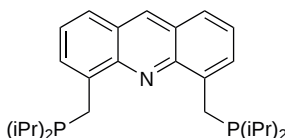
PHOSPHORUS - Ligands and Compounds

15-0415

**4,5-Bis-(di-*i*-propylphosphino-
nomethyl)acridine, 98+%
(1101230-28-7)**

$C_{27}H_{39}NP_2$; FW: 439.55; yellow xtl.
air sensitive

Note: Patents: US provisional
61/087,708, PCT/IL2009/000778.



50mg
250mg

Technical Note:

- Ligand used to make (44-0525 Milstein Acridine Catalyst).

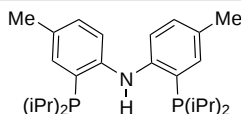
References:

- See 44-0525.

15-0670

**Bis[2-(di-*i*-propylphosphino)-4-methyl-
phenyl]amine, min. 98% (666856-94-6)**

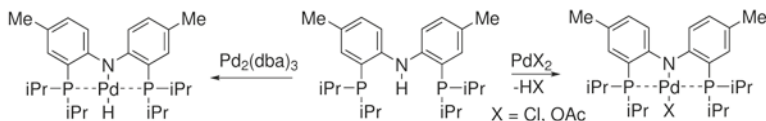
$C_{26}H_{41}NP_2$; FW: 429.56; white powdr.
air sensitive



100mg
500mg

Technical Note:

- Ligand for PNP pincer complexes of palladium



Tech. Note (1)
Ref. (1)

References:

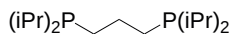
- Organometallics*, **2004**, 23, 326

15-0680

HAZ

**1,3-Bis(di-*i*-propylphosphino)propane, min. 98%
(diPPP) (91159-11-4)**

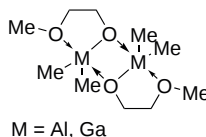
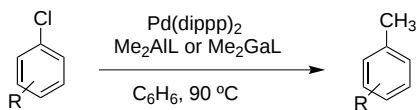
$(C_3H_7)_2PCH_2CH_2CH_2P(C_3H_7)_2$; FW: 276.38; colorless
to pale yellow liq.
air sensitive



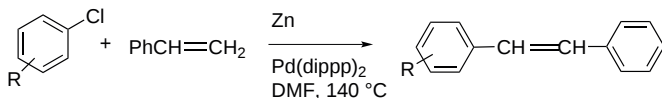
100mg
500mg
2g

Technical Notes:

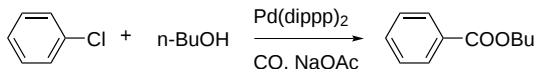
- Catalyst for the cross-methylation of aryl chlorides using stabilized dimethylaluminum or dimethylgallium reagents.
- Catalyst used in base-free olefin arylation.
- Catalyst for the efficient carbonylation of aryl chlorides.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3,4)

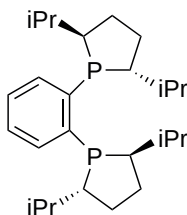
References:

- Synthesis*, **2000**, 4, 571.
- Organometallics*, **1993**, 12, 4734.
- J. Am. Chem. Soc.*, **1989**, 111, 8742.
- J. Chem. Soc. Chem. Comm.*, **1989**, 1816.

PHOSPHORUS - Ligands and Compounds

15-0410

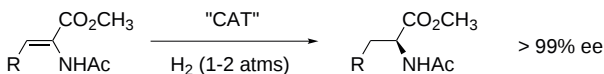
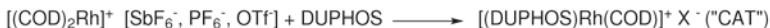
(+)-1,2-Bis((2R,5R)-2,5-di-*i*-propylphospholano)benzene, **98+%**
(R,R)-i-Pr-DUPHOS (136705-65-2)
 $C_{26}H_{44}P_2$; FW: 418.58; white xtl.; m.p. 40°
air sensitive



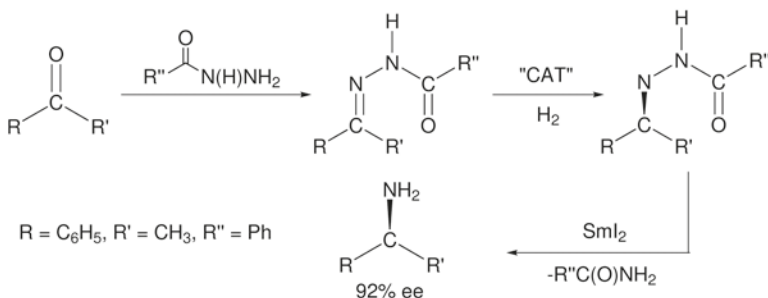
100mg
 500mg
 2g

Technical Notes:

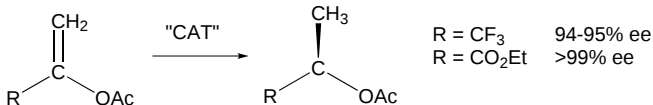
1. The DUPHOS family of catalysts is highly efficient for the asymmetric hydrogenation of various substituted acetamidoacrylates and enol acetates yielding products of high enantiomeric excesses. Efficient ligand for the asymmetric hydrogenation of tetrasubstituted enamides.⁵
2. Forms superior catalysts for asymmetric reductive aminations.
3. Catalyst used for the asymmetric hydrogenation of enol phosphonates.
4. A novel enantioselective synthesis of β -amino alcohols and 1,2-diamines.
5. Ligand for the catalytic asymmetric [4+1] cycloaddition of vinylallenes with CO.
6. Ligand for the Rh-catalyzed asymmetric enyne cycloisomerization.
7. Catalytic enantioselective addition of dialkylzinc to N-Diphenylphosphinoylimines.
8. Catalytic enantioselective addition of dialkylzinc to N-Diphenylphosphinoylimines.
8. Palladium catalyzed asymmetric phosphination.
9. Catalytic enantioselective allylation of ketones.
10. Enantioselective synthesis of cyclopropylborates.
11. Ligand used in gold catalyzed rearrangement of cyclopropylidene.



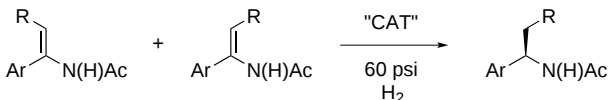
Ref. (1)



Ref. (2)



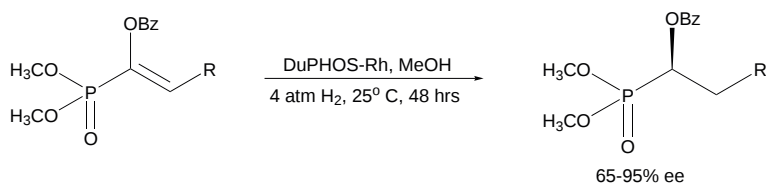
Ref. (3)



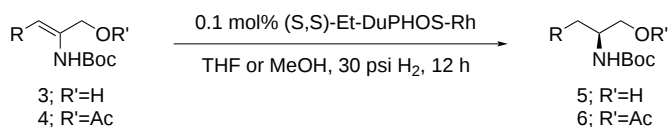
Ref. (4)

PHOSPHORUS - Ligands and Compounds

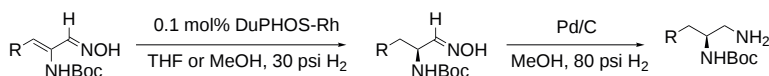
15-0410 (+)-1,2-Bis((2R,5R)-2,5-di-*i*-propylphospholano)benzene, 98+%
(continued) (R,R)-*i*-Pr-DUPHOS (136705-65-2)



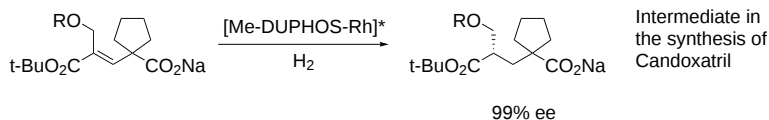
Tech. Note (3)
Ref. (7)



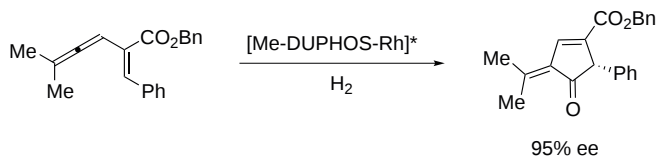
Tech. Note (4)
Ref. (8)



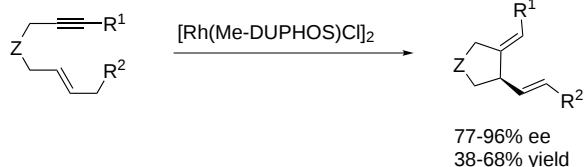
Tech. Note (4)
Ref. (8)



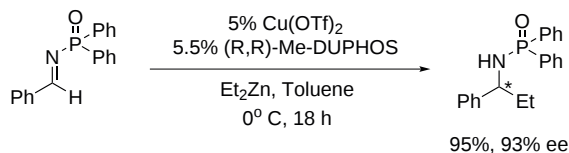
Ref. (7)



Tech. Note (5)
Ref. (8)



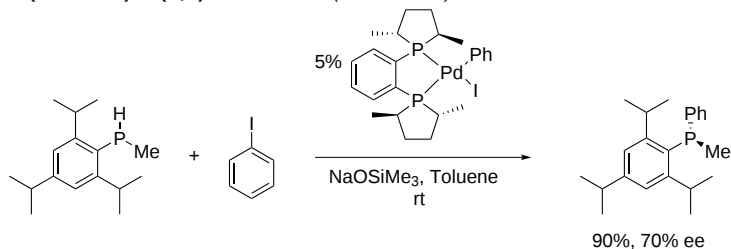
Tech. Note (6)
Ref. (9)



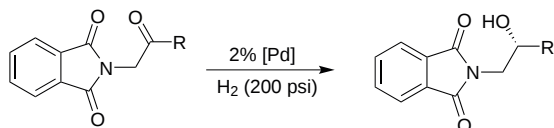
Tech. Note (7)
Ref. (13)

PHOSPHORUS - Ligands and Compounds

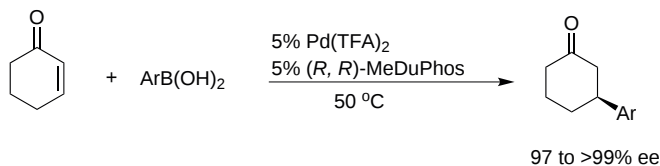
15-0410 (+)-1,2-Bis((2R,5R)-2,5-di-*i*-propylphospholano)benzene, 98+%
(continued) (R,R)-*i*-Pr-DUPHOS (136705-65-2)



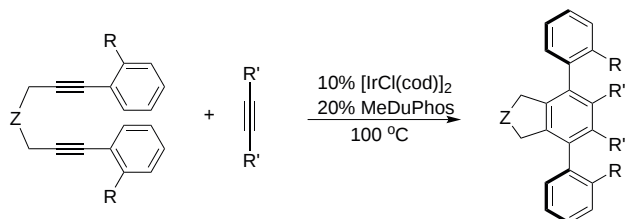
Tech. Note (8)
Ref. (14)



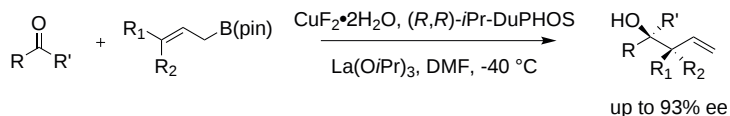
Ref. (15)



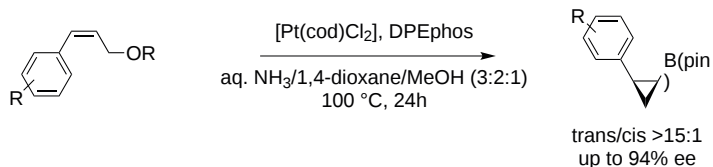
Ref. (16)



Ref. (17)



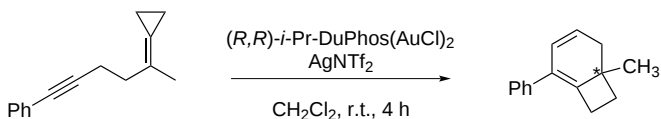
Tech. Note (9)
Ref. (18)



Tech. Note (10)
Ref. (19)

PHOSPHORUS - Ligands and Compounds

15-0410 (+)-1,2-Bis((2R,5R)-2,5-di-i-propylphospholano)benzene, 98+%
(continued) (R,R)-i-Pr-DUPHOS (136705-65-2)



Tech. Note (11)
Ref. (20)

60% ee

References:

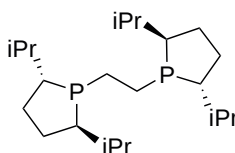
1. *J. Am. Chem. Soc.*, **1993**, *115*, 10125.
2. *J. Am. Chem. Soc.*, **1992**, *114*, 6266.
3. *J. Am. Chem. Soc.*, **1991**, *113*, 8518.
4. *J. Am. Chem. Soc.*, **1996**, *118*, 5142.
5. Burk, M.J., *Handbook of Chiral Chemicals*, Abel, Ager, D.J., Ed. (Marcel Dekker, Inc., New York, 1999) Ch 18, p 339. (review article)
6. *Organic Lett.*, **1999**, *1*, 387.
7. *Tetrahedron Lett.*, **1999**, *40*, 6685.
8. *J. Org. Chem.*, **1999**, *64*, 3290.
9. *J. Am. Chem. Soc.*, **1999**, *121*, 4130.
10. *Angew. Chem. Int. Ed.*, **2000**, *39*, 4104.
11. *Acc. Chem. Res.*, **2000**, *33*, 363-372. (review)
12. *J. Am. Chem. Soc.*, **2003**, *125*, 1692.
13. *J. Am. Chem. Soc.*, **2002**, *124*, 13356.
14. *Org. Lett.*, **2005**, *7*, 3235.
15. *Org. Lett.*, **2005**, *7*, 5309.
16. *J. Am. Chem. Soc.*, **2004**, *126*, 8382.
17. *J. Am. Chem. Soc.*, **2004**, *126*, 8910.
18. *J. Am. Chem. Soc.*, **2010**, *132*, 11440.
19. *Org. Lett.*, **2014**, *16*, 2272.

15-0411	(-)-1,2-Bis((2S,5S)-2,5-di-i-propylphospholano)benzene, 98+% (S,S)-i-Pr-DUPHOS (147253-69-8) C ₂₆ H ₄₄ P ₂ ; FW: 418.58; white xtl.; m.p. 40° <i>air sensitive</i>	100mg 500mg 2g
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Technical Note:

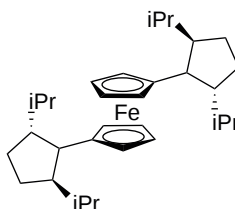
1. See 15-0410 (page 91)

15-7357 amp	1,2-Bis((2R,5R)-2,5-di-i-propylphospholano)ethane, 96% (136705-63-0) C ₂₂ H ₄₄ P ₂ ; FW: 370.53; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg
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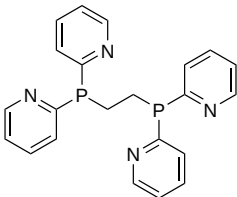
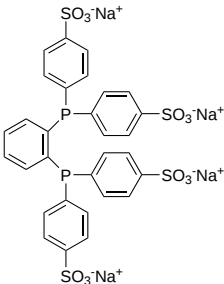
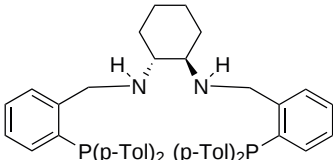
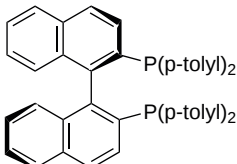


15-7358	1,2-Bis((2S,5S)-2,5-di-i-propylphospholano)ethane, min. 97% (528854-34-4) C ₂₂ H ₄₄ P ₂ ; FW: 370.53; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg
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26-1610	1,1'-Bis((2R,5R)-2,5-di-i-propylphospholano)ferrocene, min. 97% (849950-54-5) C ₃₀ H ₄₈ FeP ₂ ; FW: 526.49; yellow solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg
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PHOSPHORUS - Ligands and Compounds

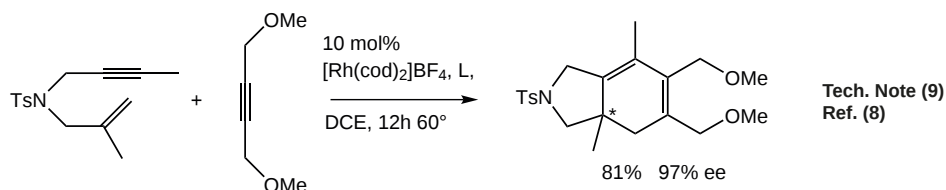
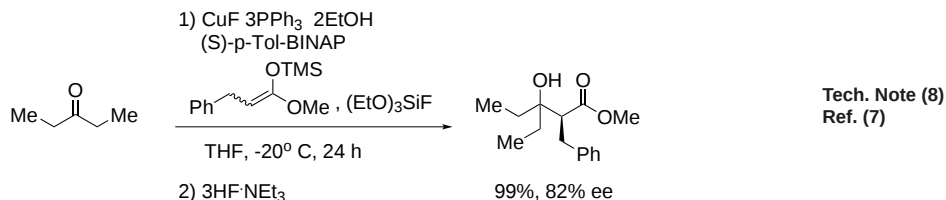
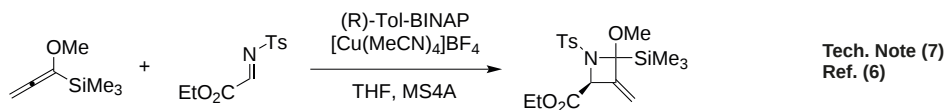
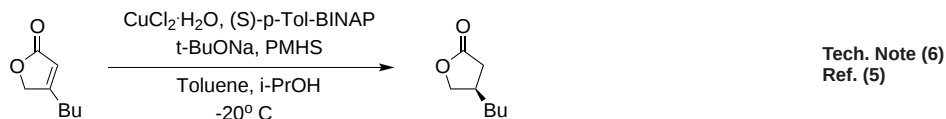
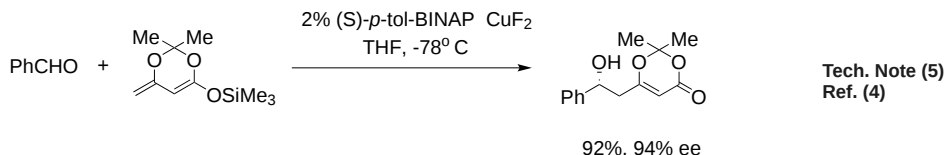
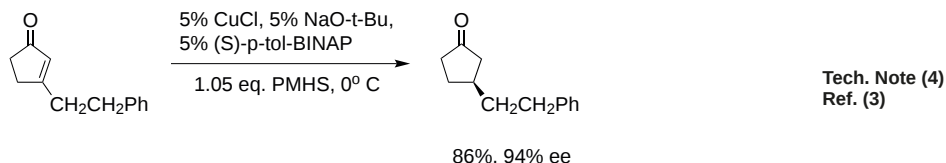
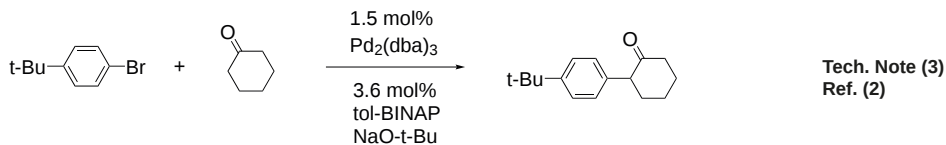
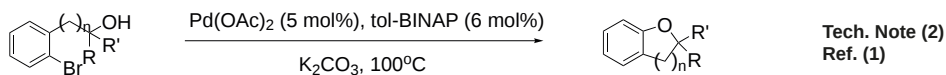
26-1611	1,1'-Bis((2S,5S)-2,5-di-i-propylphospholano)ferrocene, min. 97% (540475-73-8) $C_{30}H_{48}FeP_2$; FW: 526.49; yellow solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg
15-0683	1,2-Bis(di-2-pyridylphosphino)ethane, min. 98% (106308-26-3) $C_{22}H_{20}N_4P_2$; FW: 402.37; white powdr.	100mg 500mg
		
15-0155	1,2-Bis(di-4-sulfonatophenylphosphino)benzene tetrasodium salt DMSO adduct $C_8H_4[P(C_6H_4SO_3^-)_2]_2 \cdot 4Na^+(CH_3SOCH_3)$; FW: 854.65; off-white powdr.	1g 5g
		
15-7328	(1R,2R)-N,N-Bis[2-(di-p-tolylphosphino)benzyl]cyclohexane-1,2-diamine, min. 97% (1150113-65-7) $C_{48}H_{52}N_2P_2$; FW: 718.89; yellow solid <i>air sensitive</i>	250mg 1g
		
15-7329	(1S,2S)-N,N-Bis[2-(di-p-tolylphosphino)benzyl]cyclohexane-1,2-diamine, min. 97% (1224727-08-5) $C_{48}H_{52}N_2P_2$; FW: 718.89; yellow solid <i>air sensitive</i>	250mg 1g
15-0152	(R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-TolBINAP (99646-28-3) $C_{48}H_{40}P_2$; FW: 678.79; white powdr.; m.p. 255-257° Note: Manufactured under license of Takasago patent. Takasago BINAP Ligand Kit component.	250mg 1g 5g
		

Technical Notes:

- See 15-0150.
- Useful ligand for palladium-catalyzed carbon-oxygen bond formation.
- Ligand for palladium-catalyzed α -arylation of ketones.
- Ligand for Cu-catalyzed asymmetric conjugate reduction.
- Ligand for Cu-catalyzed asymmetric dienolate addition to aldehydes.
- Enantioselective conjugate reduction of lactones and lactams.
- Ligand used in the enantioselective cycloaddition of allenylsilanes with α -lmino esters.
- Catalytic Aldol reaction to ketones.
- Ligand with rhodium catalyses [2+2+2] cycloaddition reaction of alkenes and alkynes.
- Ligand used in the copper-catalyzed asymmetric conjugate addition of alkyl Grignard reagents on α,β -unsaturated esters.
- Ligand used in the copper-catalyzed asymmetric synthesis of cyclopropanes via tandem conjugate addition and intramolecular enolate trapping.

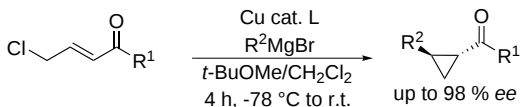
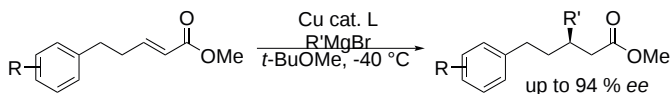
PHOSPHORUS - Ligands and Compounds

15-0152 (continued) (R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-TolBINAP (99646-28-3)



PHOSPHORUS - Ligands and Compounds

15-0152 (R)-(+)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (R)-(+)-TolBINAP (99646-28-3)
(continued)



References:

1. *J. Am. Chem. Soc.*, **1996**, *118*, 10333.
2. *J. Am. Chem. Soc.*, **1997**, *119*, 11108.
3. *J. Am. Chem. Soc.*, **2000**, *122*, 6797.
4. *J. Am. Chem. Soc.*, **1998**, *120*, 837.
5. *J. Am. Chem. Soc.*, **2003**, *125*, 11253.
6. *Org. Lett.*, **2003**, *5*(20), 3691.
7. *J. Am. Chem. Soc.*, **2003**, *125*, 5644.
8. *Org. Lett.*, **2005**, *7*(22), 4955.
9. *Chem. Commun.*, **2010**, *46*, 8694.
10. *J. Am. Chem. Soc.*, **2010**, *132*, 14349.

15-0153 (S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98%

(S)-(-)-TolBINAP (100165-88-6)

C₄₈H₄₀P₂; FW: 678.79; white powdr.; m.p. 255-257°

Note: Manufactured under license of Takasago patent. Takasago BINAP Ligand Kit component.

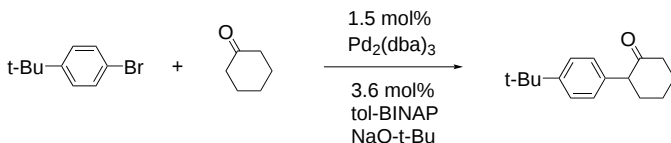
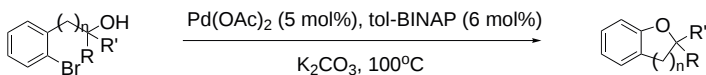
250mg

1g

5g

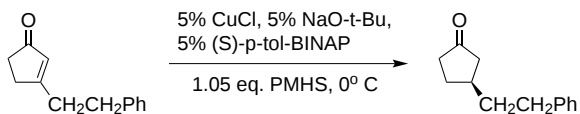
Technical Notes:

1. See 15-0150.
2. Useful ligand for palladium-catalyzed carbon-oxygen bond formation.
3. Ligand for palladium-catalyzed α -arylation of ketones.
4. Ligand for Cu-catalyzed asymmetric conjugate reduction.
5. Ligand for Cu-catalyzed asymmetric dienolate addition to aldehydes.
6. Enantioselective conjugate reduction of lactones and lactams.
7. Ligand used in the enantioselective cycloaddition of allenylsilanes with α -imino esters.
8. Catalytic Aldol reaction to ketones.
9. Ligand with rhodium catalyses [2+2+2] cycloaddition reaction of alkenes and alkynes.
10. Ligand used in the iridium-catalyzed enantioselective C-H bond activation of 2-(alkylamino)-pyridine with alkenes.
11. Iridium-catalyzed regio-, diastereo-, and enantioselective tert-(hydroxyl)-prenylation of alcohols.
12. Rhodium-catalyzed cross cyclotrimerization.



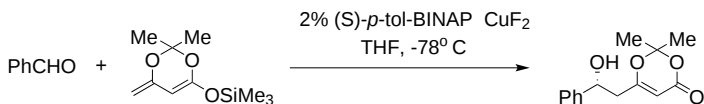
PHOSPHORUS - Ligands and Compounds

15-0153 (S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-TolBINAP (100165-88-6)
(continued)



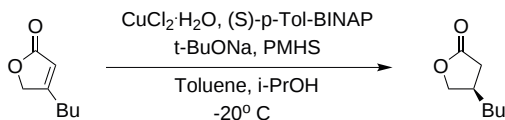
86%, 94% ee

Tech. Note (4)
Ref. (3)

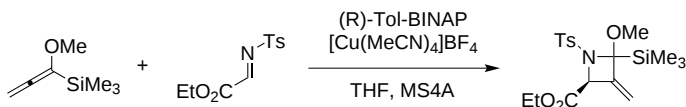


92%, 94% ee

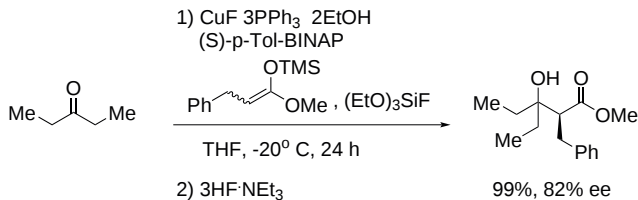
Tech. Note (5)
Ref. (4)



Tech. Note (6)
Ref. (5)



Tech. Note (7)
Ref. (6)



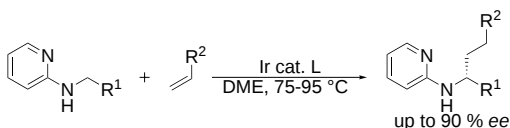
99%, 82% ee

Tech. Note (8)
Ref. (7)



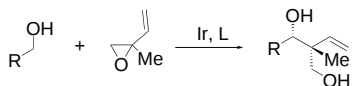
81% 97% ee

Tech. Note (9)
Ref. (8)



up to 90 % ee

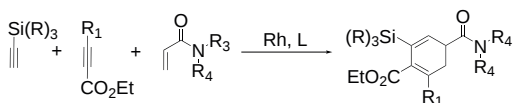
Tech. Note (10)
Ref. (9)



Tech. Note (11)
Ref. (10)

PHOSPHORUS - Ligands and Compounds

15-0153 (S)-(-)-2,2'-Bis(di-p-tolylphosphino)-1,1'-binaphthyl, 98% (S)-(-)-TolBINAP (100165-88-6)
(continued)

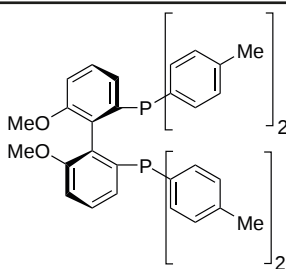


Tech. Note (12)
Ref. (11)

References:

1. *J. Am. Chem. Soc.*, **1996**, 118, 10333
2. *J. Am. Chem. Soc.*, **1997**, 119, 11108
3. *J. Am. Chem. Soc.*, **2000**, 122, 6797
4. *J. Am. Chem. Soc.*, **1998**, 120, 837
5. *J. Am. Chem. Soc.*, **2003**, 125, 11253
6. *Org. Lett.*, **2003**, 5, 20, 3691
7. *J. Am. Chem. Soc.*, **2003**, 125, 5644
8. *Org. Lett.*, **2005**, 7, 22, 4955
9. *Org. Lett.*, **2011**, 13, 4692
10. *J. Am. Chem. Soc.*, **2014**, 136, 8911
11. *Angew. Chem., Int. Ed.*, **2014**, 53, 2956

15-0156 (R)-(+)-2,2'-Bis(di-p-tolylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (133545-24-1)
C₄₂H₄₀O₂P₂; FW: 638.73;
white to pale yellow solid
Note: Sold in collaboration with
Solvias for research purposes only.
Solvias (R)-MeO BIPHEP Ligand Kit
component.

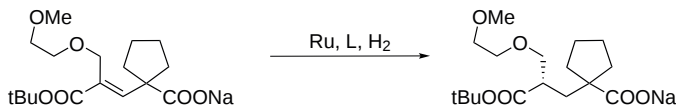


100mg
500mg
2g
10g

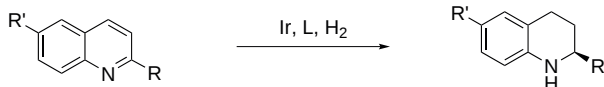
In many respects the catalytic profile of the MeOBIPHEP ligands is similar to that of other atropisomeric diphosphines such as binap and its many analogs. The nature of the PR₂ group strongly influences the catalytic performance of the metal complexes. The rhodium and ruthenium MeO-BIPHEP catalysts are highly effective for the hydrogenation of various C=O, C=C and C=N bonds and several synthetically useful C-C coupling reactions.

Technical Notes:

1. See 15-0042.
2. Ru and Ir catalyzed dynamic kinetic resolution for the synthesis of hydroxy, amino acid derivatives.
3. Ru-catalyzed asymmetric hydrogenation of ketones and alkenes.
4. Ir catalyzed enantioselective hydrogenation of heteroaromatic compounds.
5. Conjugate addition using 2-heteroaryl titanates and zinc reagents.
6. Enantio- and regioselective heck-type reaction of aryl boronic acids with 2,3-dihydrofuran
7. Rhodium-catalyzed carbonyl Z-dienylation.
8. Rhodium-catalyzed asymmetric 1,4 addition of arylboronic acids to maleimides and enones.



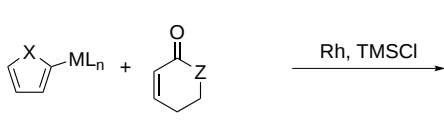
Tech. Note (3)
Ref. (3)



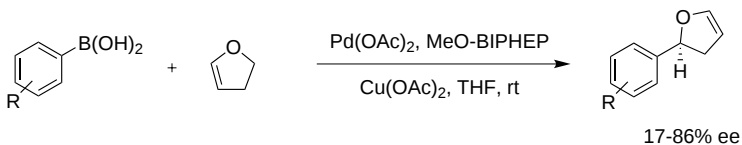
Tech. Note (4)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

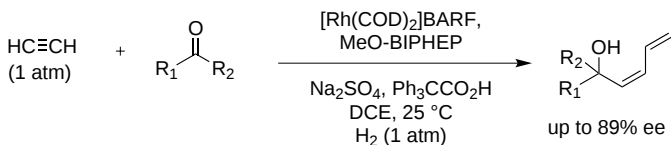
15-0153 (R)-(+)-2,2'-Bis(di-p-tolylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (133545-24-1)
(continued)



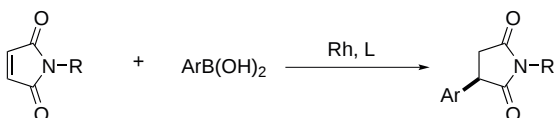
Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)



Tech. Note (8)
Ref. (8)

References:

1. *Adv. Synth. Catal.*, **2004**, 346, 842.
2. *Org. Lett.*, **2006**, 8, 4573.
3. *Org. Process Res. Devel.*, **2001**, 5, 438.
4. *J. Am. Chem. Soc.*, **2003**, 125, 10536.
5. *Org. Lett.*, **2009**, 11, 4200.
6. *J. Org. Chem.*, **2007**, 72, 3875.
7. *J. Am. Chem. Soc.*, **2006**, 128, 16040.
8. *J. Org. Chem.*, 2011, 76, 6925.

15-0157 (S)-(-)-2,2'-Bis(di-p-tolylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (133545-25-2)

C₄₂H₄₀O₂P₂; FW: 638.73; white powdr.

Note: Sold in collaboration with Solvias for research purposes only.

Solvias (S)-MeO BIPHEP Ligand Kit component.

100mg
500mg
2g
10g

Technical Note:

1. See 15-0156 (page 99)

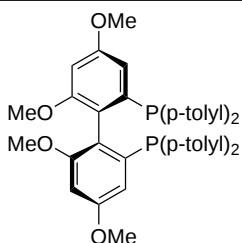
15-1657 (R)-2,2'-Bis(di-p-tolylphosphino)-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (R)-Tol-Garphos™ (1365531-81-2)

C₄₄H₄₄O₄P₂; FW: 698.77; white xtl.
air sensitive

Note: Sold in collaboration with KCT.

Patent US App No. 61/381,493.

Garphos™ Ligand Kit component.



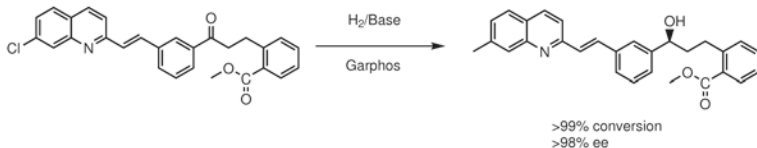
100mg
500mg

Technical Note:

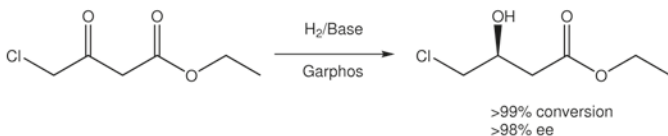
1. Chiral ligand used in the preparation of hydrogenation catalysts with exceptionally high activity and selectivity.

PHOSPHORUS - Ligands and Compounds

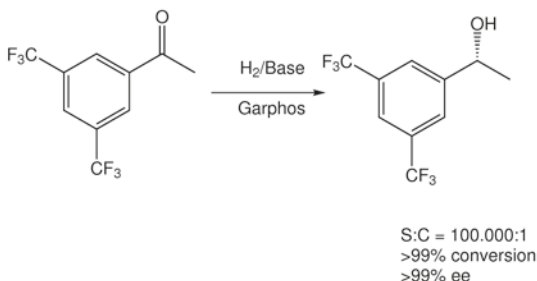
15-1657 (R)-2,2'-Bis(di-p-tolylphosphino)-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97%
(continued) (R)-Tol-Garphos™ (1365531-81-2)



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (1)

References:

- US Patent Application No. 61/381,493.

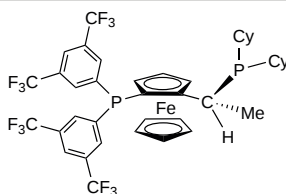
15-1658	(S)-2,2'-Bis(di-p-tolylphosphino)-4,4',6,6'-tetramethoxy-1,1'-biphenyl, min. 97% (S)-Tol-Garphos™ (1365531-82-3)	100mg 500mg
	$C_{44}H_{44}O_4P_2$; FW: 698.77; white xtl. air sensitive Note: Sold in collaboration with KCT. Patent US App No. 61/381,493. Garphos™ Ligand Kit component.	

Technical Note:

- See 15-1657 (page 100)

15-0114 HAZ	Bis(3,5-di(trifluoromethyl)phenyl)chlorophosphine, min. 98% (142421-57-6) $C_{16}H_8ClF_{12}P$; FW: 492.63; colorless liq.; m.p. 25-29° moisture sensitive	500mg 2g
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26-0960	(R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethylcyclohexylphosphine, min. 97% (292638-88-1) $C_{40}H_{40}F_{12}FeP_2$; FW: 866.56; orange powdr. Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.	100mg 500mg 2g 10g
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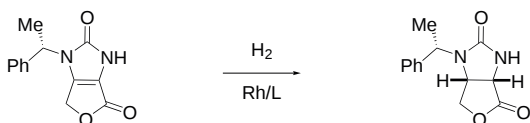
Technical Notes:

- Ferrocenylphosphine ligands of the type $cpFecp(PR_2)(^*CH(CH_3)PR'_2)$ are a class of asymmetric ligands developed at Solvias in Basel, Switzerland¹. Ligands of this type are currently used industrially in the stereoselective synthesis of commercial products^{2,3}. A unique feature of these bidentate ligands is the presence of a fixed phosphine moiety and a stereogenic, functionalized side chain, which can be easily modified to accommodate electronic and steric requirements. Based on a versatile synthetic procedure starting with optically active ferrocenes of the type $cpFecp(PR_2)(^*CH(CH_3)X)$ [$X = OAc$ or NR_2], a variety of donor atoms can be introduced into the side chain.⁴ These ferrocene based phosphine ligands have wide application in the stereoselective hydrogenation of substituted acetamidoacrylates, enol acetates, β -ketoesters and simple alkenes⁵⁻⁹.

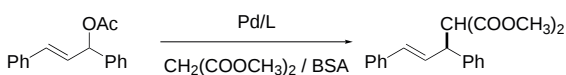
PHOSPHORUS - Ligands and Compounds

26-0960 (R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethyldi-cyclohexylphosphine, min. 97% (292638-88-1)
(continued)

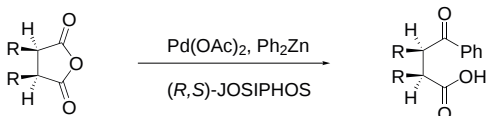
- Useful as a ligand in Pd-catalyzed C-N bond-forming reactions.
- Pd-catalyzed enantioselective alkylative desymmetrization of meso-succinic anhydrides.
- Asymmetric hydrogenation of ketones and phosphinylketimines.
- Michael addition of Grignard reagents to α,α -unsaturated esters and thioesters.
- Boration of α,α -unsaturated esters and nitriles.
- Reaction of aryl halides with ammonia.
- Cu-catalyzed reduction of activated C=C bonds with PMHS.
- Regio- and enantioselective hydroboration of vinyl arenes.
- Rh-catalyzed asymmetric ring-opening reactions of oxabicyclic alkenes.
- 1,2-Migrations in Pd-catalyzed Negishi couplings with JosiPhos ligands.
- Catalyst for the homodimerization of ketoketenes.
- Ligand for the Rh catalyzed synthesis of lactones.
- Ligand for the Cu-catalyzed synthesis of syn and anti γ -amino alcohols.



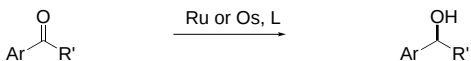
Tech. Note (1)
Ref. (3)



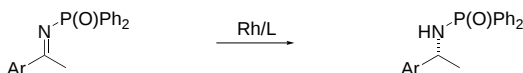
Tech. Note (1)
Ref. (5)



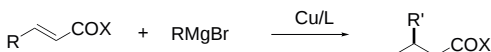
Tech. Note (3)
Ref. (12)



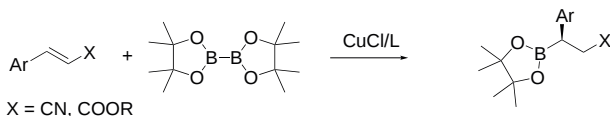
Tech. Note (4)
Ref. (13)



Tech. Note (4)
Ref. (13)



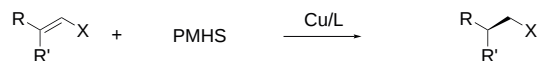
Tech. Note (5)
Ref. (14)



Tech. Note (6)
Ref. (15)

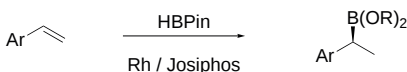


Tech. Note (7)
Ref. (16)



Tech. Note (8)
Ref. (17)

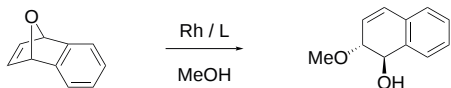
X = NO₂, COMe, CN, Het



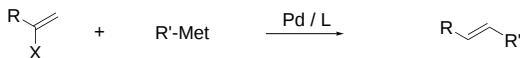
Tech. Note (9)
Ref. (19)

PHOSPHORUS - Ligands and Compounds

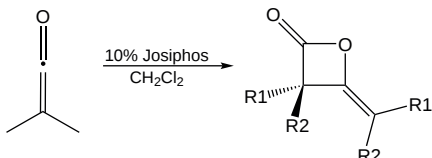
26-0960 (continued) (R)-(-)-1-[(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl]ethyldi-cyclohexylphosphine, min. 97% (292638-88-1)



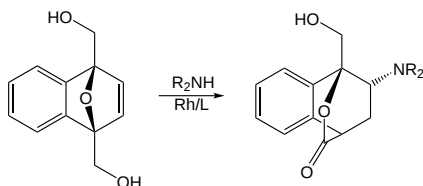
Tech. Note (10)
Ref. (20)



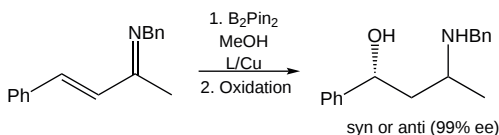
Tech. Note (11)
Ref. (21)



Tech. Note (12)
Ref. (22)



Tech. Note (13)
Ref. (23)

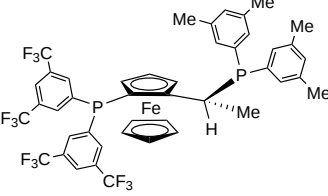
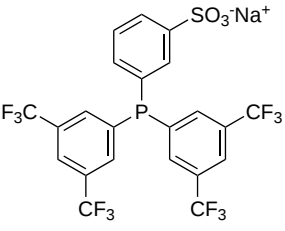
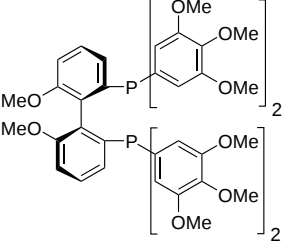


Tech. Note (14)
Ref. (25)

References:

1. Solvias uses the patent rights for Strem products 26-1000, 26-1001, 26-1200, 26-1201, 26-1230, 26-1101, and for the Ir and Rh complexes of the aforementioned products, including the complexes of 26-1210 and 26-1211.
2. *C&E News*, July **22**, 1996, 38
3. *Angew. Chem. Int. Ed.*, **1996**, 35, 1475
4. *J. Org. Chem.*, **1972**, 37, 3052
5. *J. Am. Chem. Soc.*, **1994**, 116, 4062
6. *Inorg. Chim. Acta.*, **1994**, 222, 213
7. *Organometallics*, **1996**, 15, 860
8. *Helv. Chim. Acta.*, **1995**, 78, 883
9. *European Patents*; EP 624587 **A2**, 941117, EP, 612758, A1, 940831, EP, 564406, A1, 931006
10. *Comprehensive Asymmetric Catalysis*, **1999**, Chapter, 6.1, pg, 199, 207
11. *Topics in Catalysis*, March **2002**, 19, review
12. *J. Am. Chem. Soc.*, **2004**, 126, 10248
13. (a) *Angew. Chem. Int. Ed.*, **2007**, 46, 7651, b, Adv, Synth, Catal, 2002, 343, 68
14. *Angew. Chem. Int. Ed.*, **2005**, 44, 2752
15. *Angew. Chem. Int. Ed.*, **2007**, 47, 145
16. *J. Am. Chem. Soc.*, **2006**, 128, 10028
17. (a) *Angew. Chem. Int. Ed.*, **2003**, 42, 4793. (b) *Angew. Chem, Int, Ed*, **2006**, 45, 2785. (c) *J. Am. Chem. Soc.*, **2009**, 131, 10386.
18. *Angew. Chem. Int. Ed.*, **2006**, 45, 17674, review
19. *J. Am. Chem. Soc.*, **2004**, 126, 9200
20. *Proc. Natl. Acad. Sci. U.S.A.*, **2004**, 101, 5455
21. *J. Org. Chem.*, **2009**, 74, 135
22. *J. Org. Chem.*, **2011**, 76, 7901
23. *Angew. Chem. Int. Ed.*, **2011**, 50, 7346
24. *Review: Privileged Ligands and Catalysts*, **2011**, 93
25. *Angew. Chem. Int. Ed.*, **2011**, 353, 376

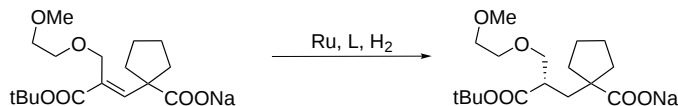
PHOSPHORUS - Ligands and Compounds

26-0965	(R)-(-)-1-{(S)-2-[Bis(3,5-di-trifluoromethylphenyl)phosphino]ferrocenyl}ethylidene-3,5-xylylphosphine, min. 97% (166172-63-0) $C_{44}H_{36}F_{12}FeP_2$; FW: 910.57; orange powdr. Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.		100mg 500mg 2g 10g
15-0572	Bis(3,5-di-trifluoromethylphenyl) (3-sulfonatophenyl)phosphine, sodium salt, min. 97% DAN2PHOS (1289463-91-7) $C_{22}H_{10}F_{12}NaO_3PS$; FW: 636.32; white solid Note: Sold under license from UAB for research purposes only. PCT/EP2010/06553.		100mg 500mg
15-1058	(R)-(+)-2,2'-Bis[di(3,4,5-trimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (256390-47-3) $C_{50}H_{56}O_{14}P_2$; FW: 942.94; off-white powdr. <i>air sensitive, (store cold)</i> Note: Sold in collaboration with Solvias for research purposes only. Solvias (R)-MeO BIPHEP Ligand Kit component.		100mg 500mg 2g 10g

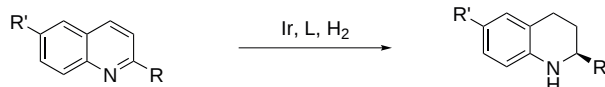
In many respects the catalytic profile of the MeOBIPHEP ligands is similar to that of other atropisomeric diphosphines such as binap and its many analogs. The nature of the PR₂ group strongly influences the catalytic performance of the metal complexes. The rhodium and ruthenium MeO-BIPHEP catalysts are highly effective for the hydrogenation of various C=O, C=C and C≡N bonds and several synthetically useful C-C coupling reactions.

Technical Notes:

1. See 15-0042.
2. Ru and Ir catalyzed dynamic kinetic resolution for the synthesis of hydroxy, amino acid derivatives.
3. Ru-catalyzed asymmetric hydrogenation of ketones and alkenes.
4. Ir catalyzed enantioselective hydrogenation of heteroaromatic compounds.
5. Conjugate addition using 2-heteroaryl titanates and zinc reagents.
6. Enantio- and regioselective heck-type reaction of aryl boronic acids with 2,3-dihydrofuran
7. Rhodium-catalyzed carbonyl Z-dienylation.
8. Rhodium-catalyzed asymmetric 1,4 addition of arylboronic acids to maleimides and enones.



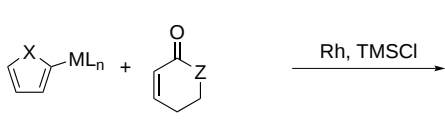
Tech. Note (3)
Ref. (3)



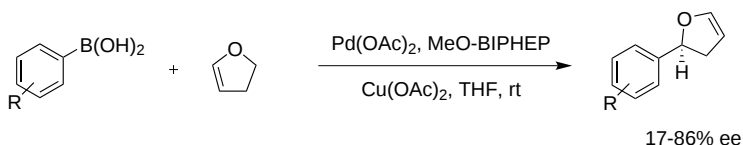
Tech. Note (4)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

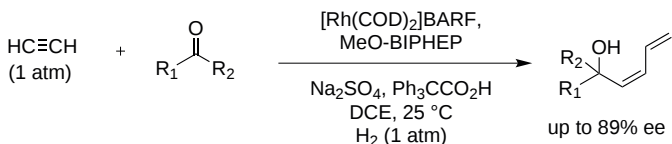
15-0158 (R)-(+)-2,2'-Bis[di(3,4,5-trimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (256390-47-3)



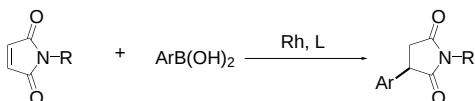
Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)



Tech. Note (8)
Ref. (8)

References:

1. *Adv. Synth. Catal.*, **2004**, 346, 842.
2. *Org. Lett.*, **2006**, 8, 4573.
3. *Org. Process Res. Devel.*, **2001**, 5, 438.
4. *J. Am. Chem. Soc.*, **2003**, 125, 10536.
5. *Org. Lett.*, **2009**, 11, 4200.
6. *J. Org. Chem.*, **2007**, 72, 3875.
7. *J. Am. Chem. Soc.*, **2006**, 128, 16040.
8. *J. Org. Chem.*, **2011**, 76, 6925.

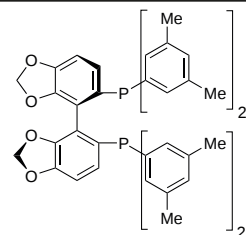
15-0159 (S)-(-)-2,2'-Bis[di(3,4,5-trimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (256235-61-7)
C₅₀H₅₆O₁₄P₂; FW: 942.94; off-white powdr.
air sensitive, (store cold)
Note: Sold in collaboration with Solvias for research purposes only.
Solvias (S)-MeO BIPHEP Ligand Kit component.

100mg
500mg
2g
10g

Technical Note:

1. See 15-0158 (page 104)

15-0478 (R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98%
(R)-(+)-DM-SEGPHOS® (850253-53-1)
C₄₆H₄₄O₄P₂; FW: 722.79; off white to pale yellow powdr.; m.p. 256-261°
Note: Manufactured under license of Takasago patent. Takasago SEGPHOS® Ligand Kit component.



250mg
1g
5g

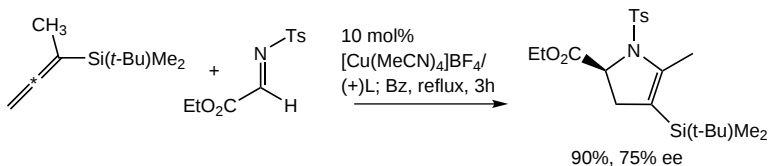
Technical Notes:

1. Biaryl bisphosphine ligand with narrow dihedral angle. The DM-SEGPHOS ligand, as the ruthenium complex, gives superior enantioselectivity and diastereoselectivity in the asymmetric hydrogenation of α-substituted-β-ketoesters. See 15-0066.
2. Copper catalyzed enantioselective [3 + 2] cycloaddition as a route to γ-amino ketones and 3-pyrrolidinones.

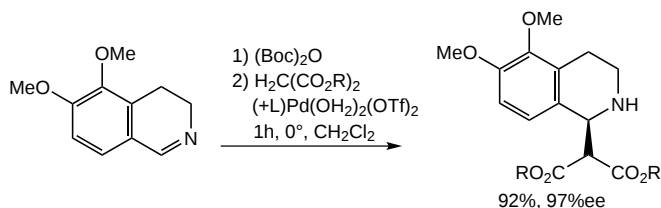
PHOSPHORUS - Ligands and Compounds

15-0478 (R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98%
(continued) (R)-(+)-DM-SEGPHOS® (850253-53-1)

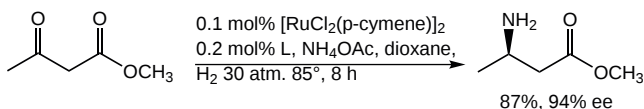
- Palladium catalyzed enantioselective addition of malonates to dihydroisoquinolines.
- Ruthenium catalyzed enantioselective synthesis of β amino acids by hydrogenation.
- Ruthenium catalyzed asymmetric hydrogenation of 3-quinuclidinone. See 44-0098 for Ru catalyst.
- Diastereo- and enantioselective ruthenium-catalyzed hydrohydroxyalkylation of 2-silyl-butadienes.
- Asymmetric [2+2+2] cycloaddition.
- Linear selective C-H activation.



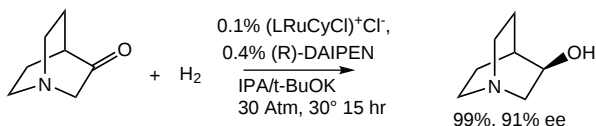
Tech. Note (2)
Ref. (1)



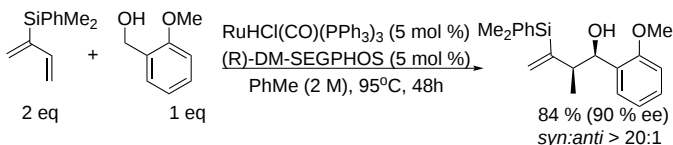
Tech. Note (3)
Ref. (2)



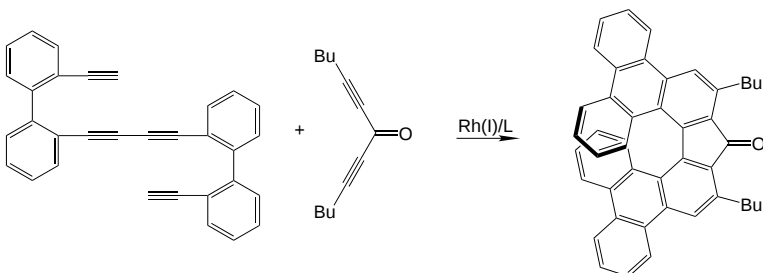
Tech. Note (4)
Ref. (3)



Tech. Note (5)
Ref. (4)



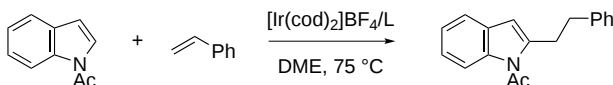
Tech. Note (6)
Ref. (5)



Tech. Note (7)
Ref. (6)

PHOSPHORUS - Ligands and Compounds

15-0478 (R)-(+)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98%
 (continued) (R)-(+)-DM-SEGPPOS® (850253-53-1)



Tech. Note (8)
 Ref. (7)

References:

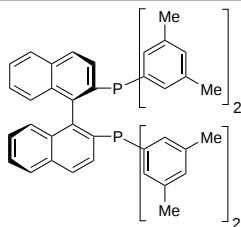
1. *Org. Lett.*, **2005**, 7, 1051.
2. *J. Am. Chem. Soc.*, **2006**, 128, 14010.
3. *WIPO Pat.* WO2005028419.
4. *U.S. Pat. App.* 2006047122.
5. *J. Am. Chem. Soc.*, **2011**, 133, 10582.
6. *J. Am. Chem. Soc.*, **2012**, 134, 4080.
7. *J. Am. Chem. Soc.*, **2012**, 134, 17474.

15-0479	(S)-(-)-5,5'-Bis[di(3,5-xylyl)phosphino]-4,4'-bi-1,3-benzodioxole, min. 98%	250mg
	(S)-(-)-DM-SEGPPOS® (210169-57-6)	1g
	C ₄₈ H ₄₄ O ₂ P ₂ ; FW: 722.79; off-white to pale yellow pwdr.; m.p. 256-261°	5g
	Note: Manufactured under license of Takasago patent. Takasago SEGPPOS® Ligand Kit component.	

Technical Note:

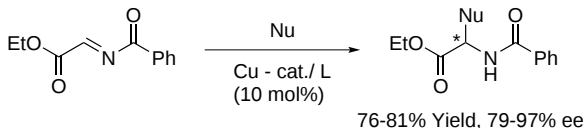
1. See 15-0478 (page 105)

15-0476	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98%	250mg
	R)-(+)-XylBINAP (137219-86-4)	1g
	C ₅₂ H ₄₈ P ₂ ; FW: 734.90; white to pale yellow xtl.; m.p. 203-206°	5g
	Note: Manufactured under license of Takasago patent. Takasago BINAP Ligand Kit component.	

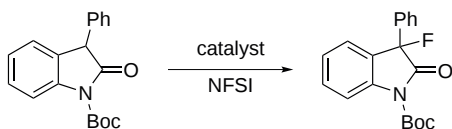


Technical Notes:

1. See 15-0150.
2. See 15-0477.
3. Ligand used in copper-catalyzed asymmetric Mannich-type reactions of N-acylimino esters.
4. Ligand used in the enantioselective fluorination of oxindoles.
5. Ligand used in [2+2+2] cycloaddition of tetraynes and hexaynes.
6. Ligand used in the asymmetric reduction of ketone via ruthenium-catalyzed transfer hydrogenation.
7. Asymmetric hydroboration of unsaturated imines.



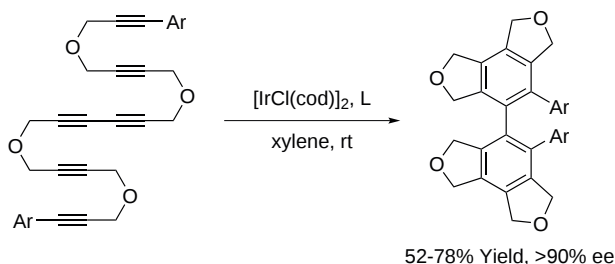
Tech. Note (3)
 Ref. (1)



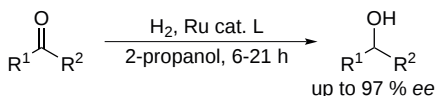
Tech. Note (4)
 Ref. (2)

PHOSPHORUS - Ligands and Compounds

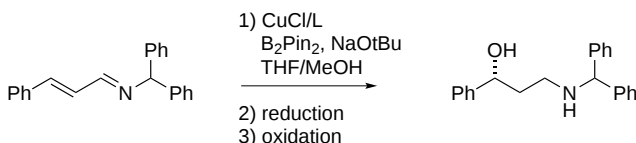
15-0476 (R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98%
(continued) (R)-(+)-XylBINAP (137219-86-4)



Tech. Note (5)
Ref. (3)



Tech. Note (6)
Ref. (4)



Tech. Note (7)
Ref. (5)

References:

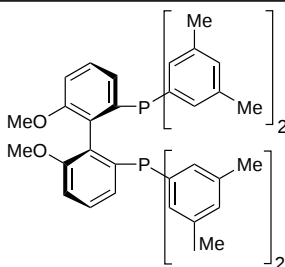
1. *J. Am. Chem. Soc.*, **2003**, 125, 2507.
2. *J. Am. Chem. Soc.*, **2005**, 127, 10164
3. *Tetrahedron*, **2008**, 64, 821.
4. *J. Am. Chem. Soc.*, **2011**, 133, 10696.
5. *Org. Lett.*, **2013**, 15, 4810.

15-0477	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-1,1'-binaphthyl, 98% (S)-(-)-XylBINAP (135139-00-3) C ₅₂ H ₄₈ P ₂ ; FW: 734.90; white to pale yellow xtl.; m.p. 203-206° Note: Manufactured under license of Takasago patent. Takasago BINAP Ligand Kit component.	250mg 1g 5g
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Technical Note:

1. See 15-0476 (page 107)

15-0488	(R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (394248-45-4) C ₄₆ H ₄₈ O ₂ P ₂ ; FW: 694.84; white powdr. (store cold) Note: Sold in collaboration with Solvias for research purposes only. Solvias (R)-MeO BIPHEP Ligand Kit component.	100mg 500mg 2g 10g
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In many respects the catalytic profile of the MeOBIPHEP ligands is similar to that of other atropisomeric diphosphines such as binap and its many analogs. The nature of the PR₂ group strongly influences the catalytic performance of the metal complexes. The rhodium and ruthenium MeO-BIPHEP catalysts are highly effective for the hydrogenation of various C=O, C=C and C=N bonds and several synthetically useful C-C coupling reactions.

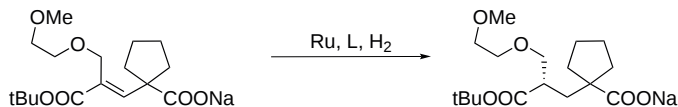
Technical Notes:

1. See 15-0042.
2. Ru and Ir catalyzed dynamic kinetic resolution for the synthesis of hydroxy, amino acid derivatives.
3. Ru-catalyzed asymmetric hydrogenation of ketones and alkenes.
4. Enantioselective copper-catalyzed asymmetric hydrosilylation of aryl ketones.

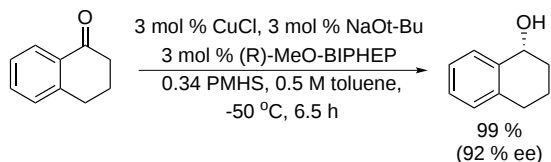
PHOSPHORUS - Ligands and Compounds

15-0488 (R)-(+)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (continued) (394248-45-4)

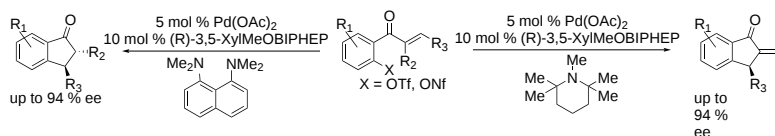
- Synthesis of chiral 3-substituted indanones via an enantioselective reductive-Heck reaction.
- Gold(I)-catalyzed enantioselective ring expansion of allenylcyclopropanols.
- Conjugate addition using 2-heteroaryl titanates and zinc reagents.



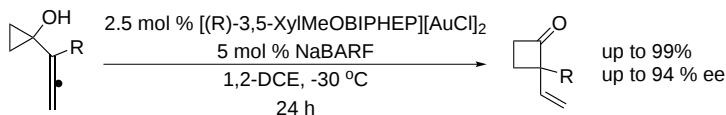
Tech. Note (3)
Ref. (3)



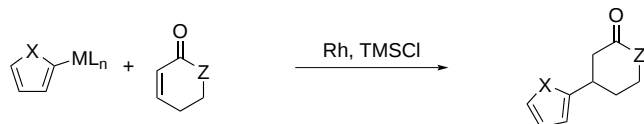
Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)

References:

- Adv. Synth. Catal.*, **2004**, 346, 842.
- Org. Lett.*, **2006**, 8, 4573.
- Org. Process Res. Devel.*, **2001**, 5, 438.
- J. Am. Chem. Soc.*, **2001**, 123, 12917.
- J. Org. Chem.*, **2007**, 72, 9253.
- J. Am. Chem. Soc.*, **2009**, 131, 9178.
- Org. Lett.*, **2009**, 11, 4200.

15-0488 (S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (362634-22-8)

C₄₆H₄₈O₂P₂; FW: 694.84; white powder.
(store cold)

Note: Sold in collaboration with Solvias for research purposes only.
Solvias (S)-MeO BIPHEP Ligand Kit component.

100mg
500mg
2g
10g

Technical Note:

- See 15-0488 (page 108)

PHOSPHORUS - Ligands and Compounds

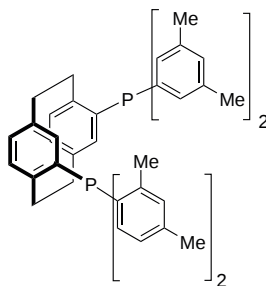
15-0730

(R)-(-)-4,12-Bis(di(3,5-xylyl)phosphino)-[2.2]-paracyclophane, min. 97% CTH-(R)-3,5-xylyl-PHANEPHOS (325168-89-6)

$C_{48}H_{50}P_2$; FW: 688.86; white powdr.

Note: Sold in collaboration with Johnson Matthey for research purposes only.

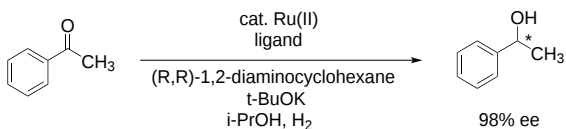
US patent Application No 5874629 and patents arising therefrom.



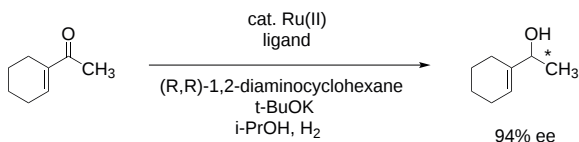
100mg
500mg

Technical Notes:

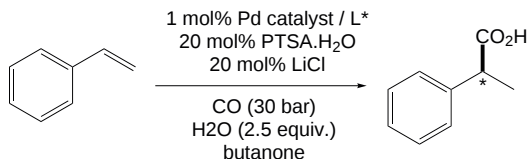
1. See 15-0425.
2. Chiral ligand employed in the enantioselective hydrogenation of various ketones.
3. Chiral ligand employed in the enantioselective hydroxycarbonylation and alkoxycarbonylation of alkenes.
4. Chiral ligand employed in the enantioselective [2+2] cycloaddition of oxabicyclic alkenes with terminal alkynes.
5. Chiral ligand employed in the gold-catalyzed enantioselective Cope rearrangement of achiral 1,5-dienes.



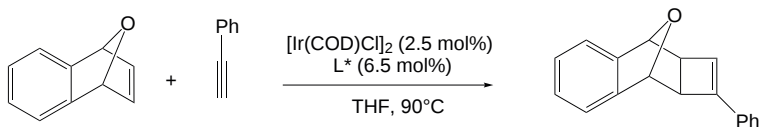
Tech. Note (2)
Ref. (1)



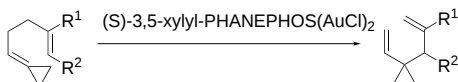
Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)



Tech. Note (4)
Ref. (3)



Tech. Note (5)
Ref. (4)

References:

1. *Org. Lett.*, **2000**, 2, 4173.
2. *Angew. Chem. Int. Ed.*, **2010**, 49, 9197.
3. *Org. Lett.*, **2010**, 12, 304.
4. *Nature Chemistry*, **2012**, 4, 405.

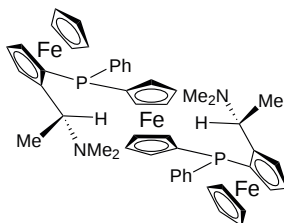
PHOSPHORUS - Ligands and Compounds

15-0731	(S)-(+)-4,12-Bis(di(3,5-xylyl)phosphino)-[2.2]-paracyclophane, min. 97% CTH-(S)-3,5-xylyl-PHANEPHOS (325168-88-5) $C_{48}H_{50}P_2$; FW: 688.86; white powdr. Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent Application No 5874629 and patents arising therefrom.	100mg
		500mg

Technical Note:

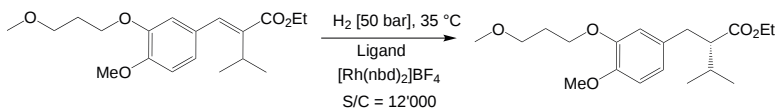
- See 15-0730 (page 110)

26-1261	1,1'-Bis{1-[(R)-ferrocenyl-2-(S)-ethyl-1-(diethylamino) phenyl]-(R)-phosphino} ferrocene, min. 97% Trifer (899811-43-9) $C_{50}H_{54}Fe_3N_2P_2$; FW: 912.46; orange powdr. Note: Sold in collaboration with Solvias for research purposes only.	100mg
		500mg 2g 10g

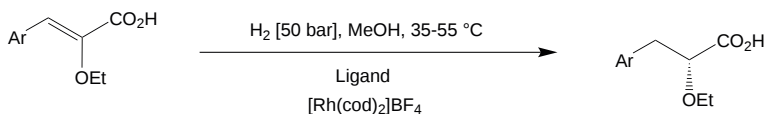


Technical Notes:

- Ligand used for the Rh-catalyzed asymmetric hydrogenation of α -substituted acrylic acids.
- Ligand used for the Rh-catalyzed asymmetric hydrogenation of 3-aryl-2-ethoxy-acrylic acids.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (1)

References:

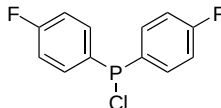
- Angew. Chem. Int. Ed. 2007, 46, 4141.

26-1260	1,1'-Bis{1-[(S)-ferrocenyl-2-(R)-ethyl-1-(dimethylamino) phenyl]-(S)-phosphino} ferrocene, min. 97% Trifer (900505-82-0) $C_{50}H_{54}Fe_3N_2P_2$; FW: 912.46; orange powdr. Note: Sold in collaboration with Solvias for research purposes only.	100mg
		500mg 2g 10g

Technical Note:

- See 26-1261 (page 111)

15-7318 HAZ	Bis(4-fluorophenyl) chlorophosphine, min. 98% (23039-97-6) $(FC_6H_4)_2ClP$; FW: 256.62; pale yellow liq. moisture sensitive	250mg 1g
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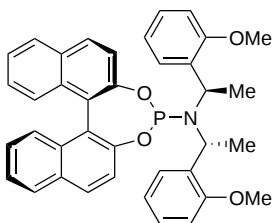


PHOSPHORUS - Ligands and Compounds

15-0522

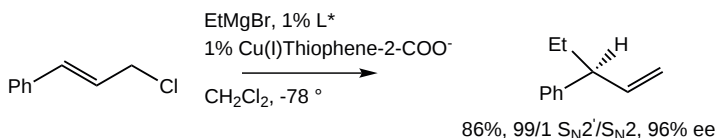
(11bR)-N,N-Bis[(R)-(-)-1-(2-methoxyphenyl)ethyl]dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-amine, min. 98%
(736158-72-8)
 $C_{38}H_{34}NO_4P$; FW: 599.65; white pwr.
moisture sensitive

100mg
500mg

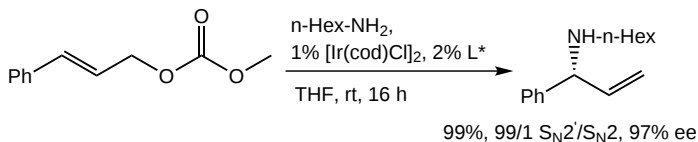


Technical Notes:

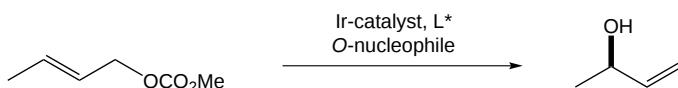
1. Ligand for the copper catalyzed, highly regioselective substitution reactions of a wide variety of aromatic and aliphatic substituted allylic halides to form branched chiral products from diverse Grignard and dialkyl zinc reagents.
2. Ligand for the iridium catalyzed, highly regioselective, substitution reactions of a wide variety of aromatic and aliphatic substituted allylic carboxylates to form branched chiral products from amines, stabilized carbanions, and aryl zinc reagents.
3. Ligand for the iridium catalyzed, highly regioselective, substitution reactions of a wide variety of aromatic and aliphatic substituted allylic carboxylates to form branched chiral products from alcohol.
4. Ligand for the iridium catalyzed, highly regioselective, substitution reactions of a wide variety of aromatic and aliphatic substituted allylic carboxylates to form branched chiral products from thiolate.
5. Ligand for the copper catalyzed, highly regioselective substitution reactions of a wide variety of aromatic and aliphatic substituted allylic halides to form branched chiral products from diverse organolithium compounds.



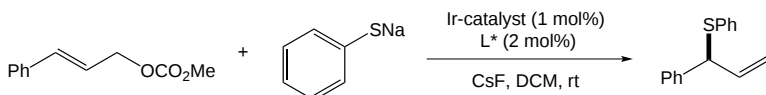
Tech. Note (1)
Ref. (1-2)



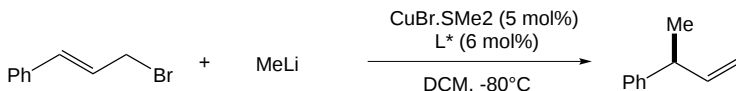
Tech. Note (2)
Ref. (1,3,4)



Tech. Note (3)
Ref. (5)



Tech. Note (4)
Ref. (6)



Tech. Note (5)
Ref. (7)

References:

1. *Angew. Chem., Int. Ed.*, **2004**, 43, 2426.
2. *Eur. J. Org. Chem.* **2008**, 3765 (review article).
3. *Chem. Comm.*, **2007**, 675 (review article).
4. *Chem. Eur. J.*, **2009**, 15, 1205.
5. *J. Am. Chem. Soc.*, **2011**, 133, 2072.
6. *Org. Lett.*, **2010**, 12, 4454.
7. *Nature Chem.*, **2011**, 377.

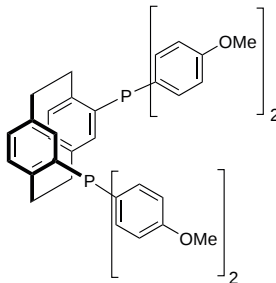
PHOSPHORUS - Ligands and Compounds

15-0523	(11bS)-N,N-Bis[(S)-(+)-1-(2-methoxyphenyl)ethyl]dinaphtho[2,1-d':1',2'-f']-[1,3,2]dioxaphosphepin-4-amine, min. 98% (776316-48-4) $C_{38}H_{34}NO_4P$; FW: 599.65; white powdr. <i>moisture sensitive</i>	100mg
		500mg

Technical Note:

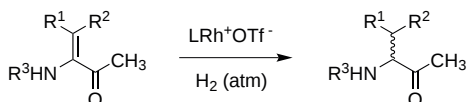
- See 15-0522 (page 112)

15-0710	(R)-4,12-Bis(4-methoxyphenyl)-[2.2]-paracyclophane R-An-Phanephos (364732-86-5) $C_{44}H_{42}O_4P$; FW: 696.75; white powdr. Note: Sold in collaboration with JM for research purposes only.	100mg
		500mg

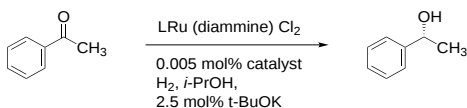


Technical Notes:

- Highly enantioselective catalyst for the hydrogenation of dehydroamino acids, methyl esters under mild conditions.
- Asymmetric hydrogenation of a wide variety of aromatic, heteroaromatic, and α - β unsaturated ketones.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

- J. Am. Chem. Soc.*, **1997**, *119*, 6207.
- Org. Lett.*, **2000**, *2*, 4173.

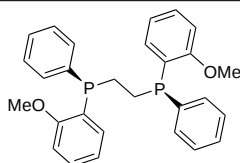
15-0711	(S)-4,12-Bis(4-methoxyphenyl)-[2.2]-paracyclophane S-An-Phanephos $C_{44}H_{42}O_4P$; FW: 696.75; white powdr. Note: Sold in collaboration with JM for research purposes only.	100mg
		500mg

Technical Note:

- See 15-0710 (page 113)

15-0466	Bis(2-methoxyphenyl)phenylphosphine , min. 98% (36802-41-2) $(C_6H_4OCH_3)_2P(C_6H_5)$; FW: 322.34; white xtl.; m.p. 163-164°	1g
		5g 25g

15-0481	(R,R)-(-)-1,2-Bis[(2-methoxyphenyl)(phenyl)phosphino]ethane, 98% (-)-DIPAMP (55739-58-7) $(C_6H_4OCH_3)(C_6H_5)PCH_2CH_2P(C_6H_4OCH_3)(C_6H_5)$; FW: 458.47; white xtl.; m.p. 102-103°	250mg
		1g



Technical Note:

- Rhodium DIPAMP catalysts have shown high activity and enantioselectivity in the asymmetric hydrogenation of enamides, enol acetates and olefins.

References:

- ACS Symposium Series*, **1993**, 517 (Selectivity in Catalysis), 58-74 (review).
- Acc. Chem. Res.*, **1983**, *16*, 106 (review).

PHOSPHORUS - Ligands and Compounds

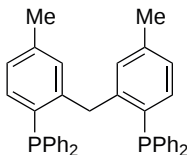
15-0482	(S,S)-(+)-1,2-Bis[(2-methoxyphenyl)(phenyl)phosphino]ethane, 98% (+)-DIPAMP (97858-62-3) (C ₆ H ₄ OCH ₃)(C ₆ H ₅)PCH ₂ CH ₂ P(C ₆ H ₄ OCH ₃)(C ₆ H ₅); FW: 458.47; white xtl.; m.p. 102-103°	250mg 1g
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Technical Note:

- See 15-0482 (page 114)

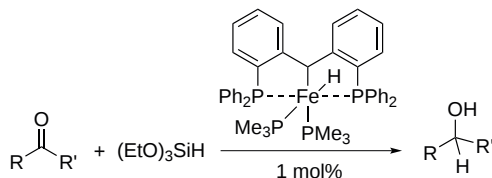
15-0358	Bis[2-(4-methyldiphenylphosphino)phenyl]methane, 90% C ₃₉ H ₃₄ P ₂ ; FW: 564.64; white powdr.	100mg 500mg 2g
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NEW



Technical Note:

- Alternative ligand for the iron catalyzed reduction of ketones



Tech. Note (1)
Ref. (1)

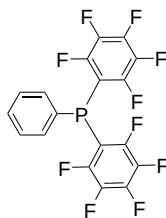
References:

- Organometallics*, **2014**, 33, 3535 (Note: This reference is for the non-methylated analog.)

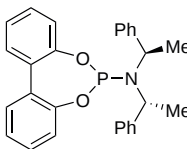
15-0115	Bis(1-naphthyl)chlorophosphine, min. 97% (36042-99-6) C ₂₀ H ₁₄ ClP; FW: 320.75; white to pale yellow xtl. <i>moisture sensitive</i>	500mg 2g
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15-0374	Bis(pentafluorophenyl)phenylphosphine, 97% (5074-71-5) C ₁₈ H ₅ F ₁₀ P; FW: 442.20; white powdr.; m.p. 59-61°; b.p. 105°C/0.3mm; f.p. >110°C <i>air sensitive</i>	250mg 1g
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NEW



15-0518	N,N-Bis[(1R)-(+)-phenylethyl]dibenzo[d,f][1,3,2]dioxaphosphepin-6-amine (500103-26-4) C ₂₈ H ₂₈ NO ₂ P; FW: 439.49; white powdr. <i>moisture sensitive</i>	100mg 500mg
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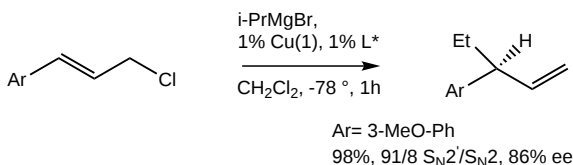


Technical Notes:

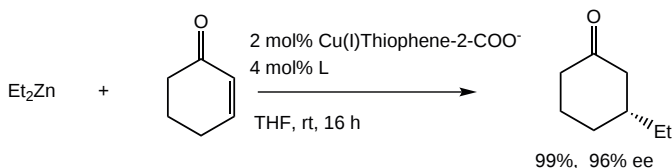
- Ligand for the copper catalyzed, highly regioselective substitution reactions of a wide variety of aromatic substituted allylic halides to form branched chiral products from diverse Grignard reagents.
- Ligand for the copper catalyzed, highly enantioselective conjugate addition of diethylzinc to eneones and nitro olefins.
- Ligand for the nickel catalyzed, highly enantioselective hydrovinylation of alkenes.
- Ligand for the rhodium catalyzed, highly enantioselective hydroformylation of vinylarenes.
- Ligand for gold catalyzed asymmetric Intramolecular hydroamination of allenes

PHOSPHORUS - Ligands and Compounds

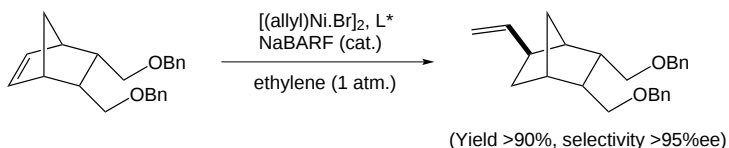
15-0518 N,N-Bis[(1R)-(+)-phenylethyl]dibenzo[d,f][1,3,2]dioxaphosphepin-6-amine (500103-26-4)
(continued)



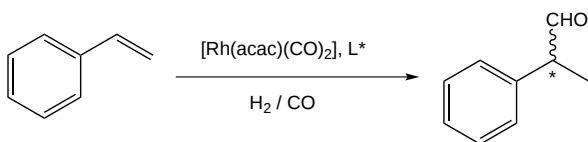
Tech. Note (1)
Ref. (1,2)



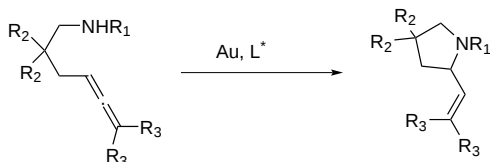
Tech. Note (2)
Ref. (3,4)



Tech. Note (3)
Ref. (5)



Tech. Note (4)
Ref. (6)



Tech. Note (5)
Ref. (7)

References:

1. *Org. Lett.*, **2002**, 4, 4147
2. *Eur. J. Org. Chem.*, **2008**, 3765 (review article).
3. *J. Am. Chem. Soc.*, **2002**, 124, 5262.
4. *Synlett*, **2001**, 9, 1375.
5. *J. Org. Chem.*, **2010**, 75, 7636.
6. *Tetrahedron Asymmetry*, **2010**, 21, 2153.
7. *Organometallics*, **2013**, 32, 5589.

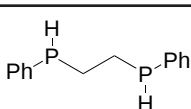
15-0519 N,N-Bis[(1S)-(-)-phenylethyl]dibenzo[d,f][1,3,2]dioxaphosphepin-6-amine (376355-58-7)
C₂₈H₂₆NO₂P; FW: 439.49; white powdr.
moisture sensitive

100mg
500mg

Technical Note:

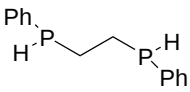
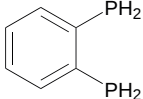
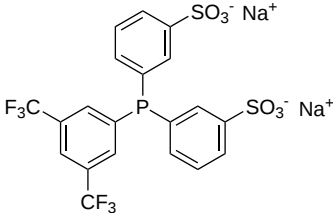
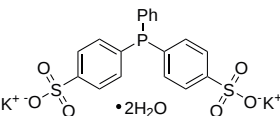
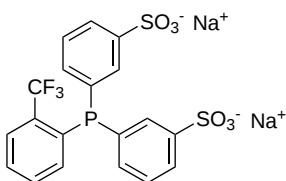
1. See 15-0518 (page 114)

15-0405 1,2-Bis(phenylphosphino)ethane, min. 90%
(18899-64-4)
(C₆H₅)₂HPCH₂CH₂PH(C₆H₅); FW: 246.22;
colorless to yellow liq.
pyrophoric



500mg
2g

PHOSPHORUS - Ligands and Compounds

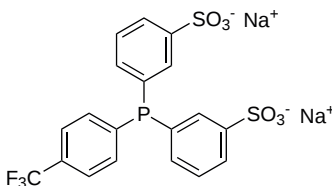
15-0409 HAZ	1,2-Bis(phenylphosphino)ethane, min. 95% (10wt% in hexanes) (18899-64-4) (C ₆ H ₅) ₂ HPCH ₂ CH ₂ PH(C ₆ H ₅); FW: 246.22; colorless liq. <i>air sensitive</i>		5g 20g
15-0456 amp HAZ	1,3-Bis(phenylphosphino)propane, 90-95% (28240-66-6) C ₆ H ₅ P(H)CH ₂ CH ₂ CH ₂ (H)PC ₆ H ₅ ; FW: 260.26; colorless liq.; b.p. 160-165°/1 mm <i>air sensitive</i>		1g 5g
15-0461 amp HAZ 	1,2-Bis(phosphino)benzene, 98+% (80510-04-9) C ₆ H ₄ (PH ₂) ₂ ; FW: 142.08; colorless liq.; b.p. 53-55°/0.25mm; d. 1.101 <i>pyrophoric</i>		1g 5g
15-0462 HAZ	1,2-Bis(phosphino)benzene, 98+% (10 wt% in hexanes) (80510-04-9) C ₆ H ₄ (PH ₂) ₂ ; FW: 142.08; colorless liq. <i>air sensitive</i>		10g 50g
15-0459 amp HAZ 	1,2-Bis(phosphino)ethane, 99% (5518-62-7) H ₂ PCH ₂ CH ₂ PH ₂ ; FW: 92.02; colorless liq.; b.p. 109-110° <i>pyrophoric</i>		250mg 1g
15-0570	Bis(3-sulfonatophenyl)(3,5-di-trifluoromethylphenyl)phosphine, disodium salt monohydrate, min. 97% DANPHOS (water soluble) (1289463-82-6) C ₂₀ H ₁₃ F ₆ Na ₂ O ₆ PS ₂ ·H ₂ O; FW: 604.39 (622.41); white powdr. Note: Water soluble phosphine. Sold under license from UAB for research purposes only. PCT/EP2010/065531.		100mg 500mg
15-0638 NEW	Bis(p-sulfonatophenyl)phenylphosphine dihydrate dipotassium salt, 97% (308103-66-4) C ₁₈ H ₁₃ K ₂ O ₆ PS ₂ ; FW: 498.60(534.63); white powdr.; m.p. 98-102° <i>air sensitive</i>		100mg 500mg
15-0463	Bis(p-sulfonatophenyl)phenylphosphine dihydrate dipotassium salt, min. 97% (151888-20-9) C ₆ H ₅ P(C ₆ H ₄ SO ₃ K) ₂ ·2H ₂ O; FW: 498.58 (534.62); white powdr.		500mg 2g 10g
Technical Note: 1. A water-soluble phosphine ligand used in the formation of water-soluble catalysts.			
15-0577	Bis(3-sulfonatophenyl)(2-trifluoromethylphenyl)phosphine, disodium dihydrate, min. 97% o-DANPHOS (1289463-84-8) C ₁₉ H ₁₂ F ₃ Na ₂ O ₆ PS ₂ ·2H ₂ O; FW: 534.38 (570.41); white powdr. Note: Water soluble phosphine. Sold under license from UAB for research purposes only. PCT/EP2010/065531.		100mg 500mg

PHOSPHORUS - Ligands and Compounds

15-0575

Bis(3-sulfonatophenyl)(4-trifluoromethylphenyl)phosphine disodium dihydrate, min. 97% p-DANPHOS (1289463-79-1)

$C_{19}H_{12}F_3Na_2O_6PS_2 \cdot 2H_2O$;
FW: 534.38 (570.41); white powdr.
Note: Water soluble phosphine.
Sold under license from UAB for research purposes only. PCT/EP2010/065531.

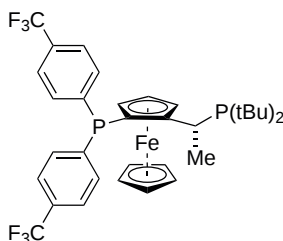


100mg
500mg

26-0650

(R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97% (246231-79-8)

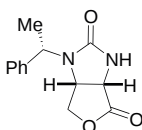
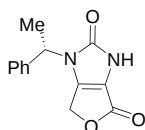
$C_{34}H_{38}F_6FeP_2$; FW: 678.45;
orange powdr.
Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.



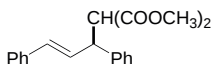
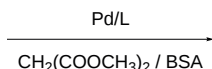
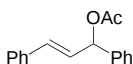
100mg
500mg
2g
10g

Technical Notes:

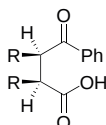
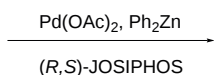
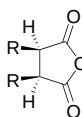
1. Ferrocenylphosphine ligands of the type $cpFecp(PR_2)(^*CH(CH_3)PR'_2)$ are a class of asymmetric ligands developed at Solvias in Basel, Switzerland¹. Ligands of this type are currently used industrially in the stereoselective synthesis of commercial products^{2,3}. A unique feature of these bidentate ligands is the presence of a fixed phosphine moiety and a stereogenic, functionalized side chain, which can be easily modified to accommodate electronic and steric requirements. Based on a versatile synthetic procedure starting with optically active ferrocenes of the type $cpFecp(PR_2)(^*CH(CH_3)X)$ [$X = OAc$ or NR_2], a variety of donor atoms can be introduced into the side chain.⁴ These ferrocene based phosphine ligands have wide application in the stereoselective hydrogenation of substituted acetamidoacrylates, enol acetates, β -ketoesters and simple alkenes⁵⁻⁹.
2. Useful as a ligand in Pd-catalyzed C-N bond-forming reactions.
3. Pd-catalyzed enantioselective alkylative desymmetrization of *meso*-succinic anhydrides.
4. Asymmetric hydrogenation of ketones and phosphinylketimines.
5. Michael addition of Grignard reagents to α,α -unsaturated esters and thioesters.
6. Boration of α,α -unsaturated esters and nitriles.
7. Reaction of aryl halides with ammonia.
8. Cu-catalyzed reduction of activated C=C bonds with PMHS.
9. Regio- and enantioselective hydroboration of vinyl arenes.
10. Rh-catalyzed asymmetric ring-opening reactions of oxabicyclic alkenes.
11. 1,2-Migrations in Pd-catalyzed Negishi couplings with JosiPhos ligands.
12. Catalyst for the homodimerization of ketoketenes.
13. Ligand for the Rh catalyzed synthesis of lactones.
14. Ligand for the Cu-catalyzed synthesis of syn and anti γ -amino alcohol



Tech. Note (1)
Ref. (3)



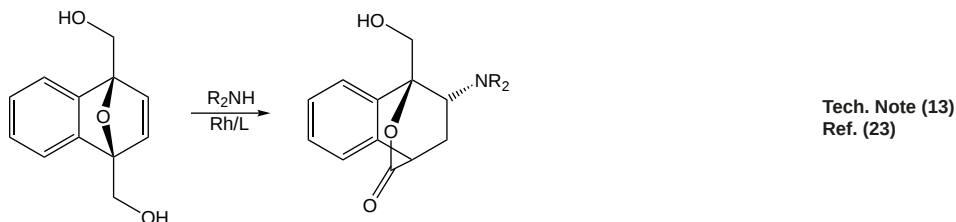
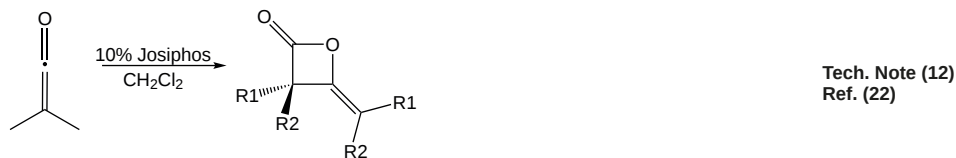
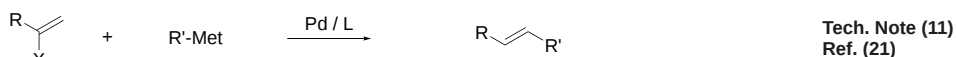
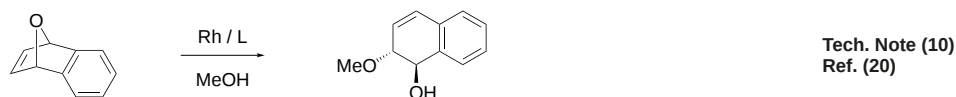
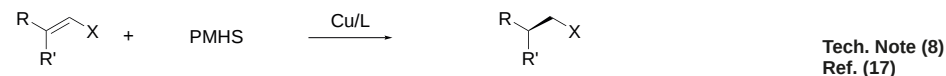
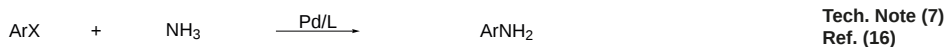
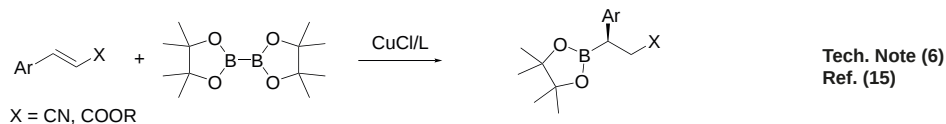
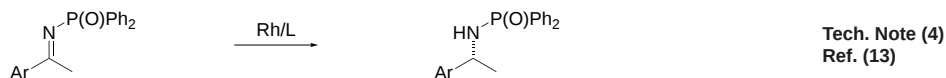
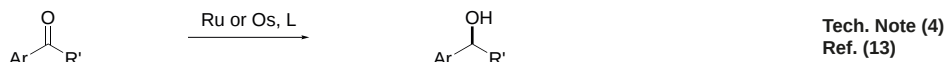
Tech. Note (1)
Ref. (5)



Tech. Note (3)
Ref. (12)

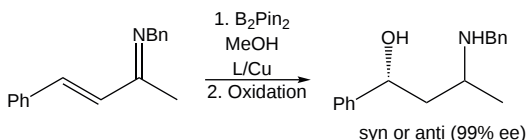
PHOSPHORUS - Ligands and Compounds

26-0650 (continued) (R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97% (246231-79-8)



PHOSPHORUS - Ligands and Compounds

26-0650 (R)-(-)-1-[(S)-2-[Bis(4-trifluoromethylphenyl) phosphino]ferrocenyl] ethyl-di-t-butylphosphine, min. 97% (246231-79-8)

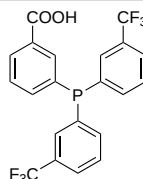


Tech. Note (14)
Ref. (25)

References:

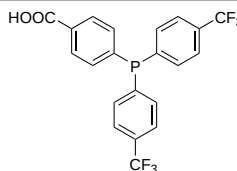
1. Solvias owns the patent rights for Strem products 26-1000, 26-1001, 26-1200, 26-1201, 26-1230, 26-1101 and for the Ir and Rh complexes of the aforementioned products including the complexes 26-1210 and 26-1211.
2. *C&E News*, July 22, 1996, 38
3. *Angew. Chem. Int. Ed.*, **1996**, 35, 1475
4. *J. Org. Chem.*, **1972**, 37, 3052
5. *J. Am. Chem. Soc.*, **1994**, 116, 4062
6. *Inorg. Chim. Acta.*, **1994**, 222, 213
7. *Organometallics*, **1996**, 15, 860
8. *Helv. Chim. Acta.*, **1995**, 78, 883
9. *European Patents*; EP 624587 **A2**, 941117, EP, 612758, A1, 940831, EP, 564406, A1, 931006
10. *Comprehensive Asymmetric Catalysis*, **1999**, Chapter, 6.1, pg, 199, 207
11. *Topics in Catalysis*, March **2002**, 19, review
12. *J. Am. Chem. Soc.*, **2004**, 126, 10248
13. (a) *Angew. Chem. Int. Ed.*, **2007**, 46, 7651, b, *Adv. Synth. Catal.*, 2002, 343, 68
14. *Angew. Chem. Int. Ed.*, **2005**, 44, 2752
15. *Angew. Chem. Int. Ed.*, **2007**, 47, 145
16. *J. Am. Chem. Soc.*, **2006**, 128, 10028
17. (a) *Angew. Chem. Int. Ed.*, **2003**, 42, 4793, b, *Angew. Chem. Int. Ed.*, 2006, 45, 2785
18. *Angew. Chem. Int. Ed.*, **2006**, 45, 17674, review
19. *J. Am. Chem. Soc.*, **2004**, 126, 9200
20. *Proc. Natl. Acad. Sci. U.S.A.*, **2004**, 101, 5455
21. *J. Org. Chem.*, **2009**, 74, 135
22. *J. Org. Chem.* **2011**, 76, 7901
23. *Angew. Chem. Int. Ed.* **2011**, 50, 7346
24. *Review: Privileged Ligands and Catalysts*, **2011**, 93
25. *Angew. Chem. Int. Ed.* **2011**, 353, 376

15-0265 **Bis(3-trifluoromethylphenyl)(3-carboxyphenyl) phosphine**, min. 97% **m-Miranphos** (1808959-38-7)
C₂₁H₁₃F₆O₂P; FW: 442.29; white solid
Note: Sold under license from UAB for research purposes only. Spanish Patent Application P201231702.



100mg
500mg

15-0260 **Bis(4-trifluoromethylphenyl)(4-carboxyphenyl)phosphine**, min. 97% **p-Miranphos** (1808959-36-5)
C₂₁H₁₃F₆O₂P; FW: 442.29; white pwdr.
Note: Sold under license from UAB for research purposes only. Spanish Patent Application P201231702.



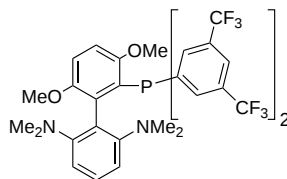
100mg
500mg

PHOSPHORUS - Ligands and Compounds

15-3015

NEW

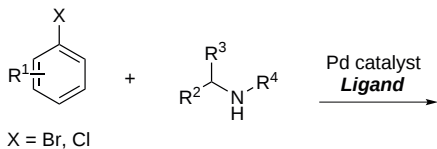
2-[Bis(3,5-trifluoromethylphenyl)phosphino]-3,6-dimethoxy-2',6'-dimethylamino-1,1'-biphenyl, 98% (1810068-30-4)
 $C_{34}H_{29}F_{12}N_2O_2P$; FW: 756.56;
 white to off-white powdr.
 Note: Patents: US 6,395,916, US 6,307,087



100mg
500mg
2g

Technical Note:

- Ligand for the Palladium-catalyzed arylation of α -Branched Secondary Amines



X = Br, Cl

References:

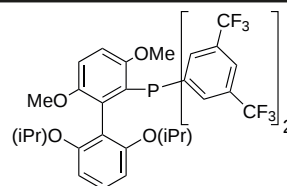
- Angew. Chem. Int. Ed.*, **2015**, 54, 8259

Tech. Note (1)
Ref. (1)

15-3020

NEW

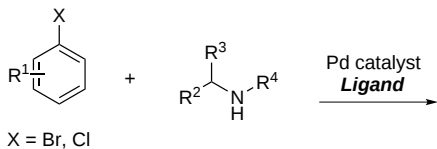
2-[Bis(3,5-trifluoromethylphenyl)phosphino]-3,6-dimethoxy-2',6'-di-*i*-propoxy-1,1'-biphenyl, 98% (1810068-31-5)
 $C_{36}H_{31}F_{12}O_4P$; FW: 786.58;
 white to off-white powdr.
 Note: Patents: US 6,395,916, US 6,307,087



250mg
1g
5g

Technical Note:

- Ligand for the Palladium-catalyzed arylation of α -Branched Secondary Amines



X = Br, Cl

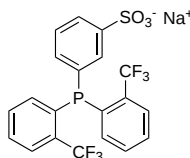
References:

- Angew. Chem. Int. Ed.*, **2015**, 54, 8259

Tech. Note (1)
Ref. (1)

15-0579

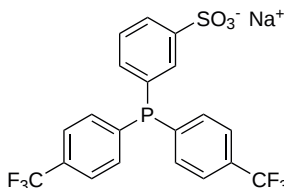
Bis(2-trifluoromethylphenyl)(3-sulfonatophenyl)phosphine, sodium salt, min. 97% α -DAN2PHOS (1289463-93-9)
 $C_{20}H_{12}F_6NaO_3PS$; FW: 500.33; white powdr.
 Note: Sold under license from UAB for research purposes only. PCT/EP2010/065531.



100mg
500mg

15-0582

Bis(4-trifluoromethylphenyl)(3-sulfonatophenyl)phosphine, sodium salt, min. 97% p -DAN2PHOS (1289463-87-1)
 $C_{20}H_{12}F_6NaO_3PS$; FW: 500.33;
 white powdr.
 Note: Sold under license from UAB for research purposes only. PCT/EP2010/065531.



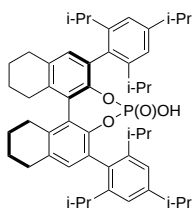
100mg
500mg

PHOSPHORUS - Ligands and Compounds

15-1395

NEW

(R)-3,3'-Bis(2,4,6-triisopropylphenyl)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl-2,2'-diyl Hydrogenphosphate, 98%, (99% ee) (929294-27-9)
 $C_{50}H_{65}O_4P$; FW: 761;
 White to light-yellow powdr.
 Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

15-1394

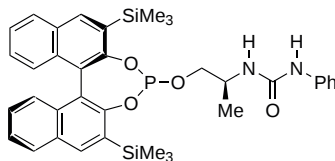
NEW

(S)-3,3'-Bis(2,4,6-triisopropylphenyl)-5,5',6,6',7,7',8,8'-octahydro-1,1'-binaphthyl-2,2'-diyl Hydrogenphosphate, 98%, (99% ee) (878111-20-7)
 $C_{50}H_{65}O_4P$; FW: 761; White to light-yellow powdr.
 Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-2216

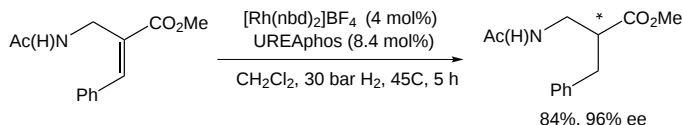
1-(2S)-1-[(11bR)-2,6-Bis(trimethylsilyl)dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yloxy]propan-2-yl]-3-phenylurea, min. 97% (1357562-70-9)
 $C_{36}H_{41}N_2O_4PSi_2$; FW: 652.87;
 white powdr.
moisture sensitive, (store cold)
 Note: Sold under license from InCatT for research purposes only.
 WO2004/103559. UREAPhos and METAMORPhos Ligand Kit component.



50mg
250mg

Technical Note:

- The UREAPhos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



References:

- J. Chem. Soc. Chem. Comm., 2007, 864.
- WO2004103559A2.

93-1570

HAZ

Bis(triphenylphosphine)iminium borohydride, min. 97% (65013-26-5)
 $[(C_6H_5)_3P]_2NBH_4$; FW: 553.44; white powdr.
moisture sensitive

2g
10g

15-0455

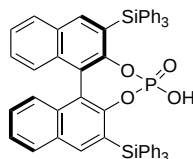
Bis(triphenylphosphine)iminium chloride, 97% (21050-13-5)
 $[(C_6H_5)_3P]_2NCl$; FW: 574.04; white powdr.; m.p. 260-265°

5g
25g

15-0340

NEW

(R)-(-)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl-2,2'-diyl hydrogen phosphate, min. 98% [(R)-TIPSY] (791616-55-2)
 $C_{56}H_{41}O_4PSi_2$; FW: 865.07;
 white to light-yellow powdr.; m.p. 329-335°
 Note: Sold in collaboration with Daicel for research purposes only.



10mg
100mg

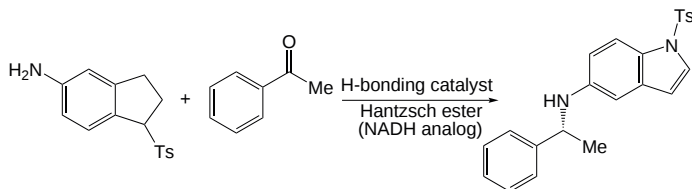
Technical Notes:

- A chiral phosphoric acid catalyst providing a highly stereoselective method for the reductive amination of heterocyclic amines.
- Chiral phosphoric acid used for the enantioselective Biginelli and Biginelli-like reactions.

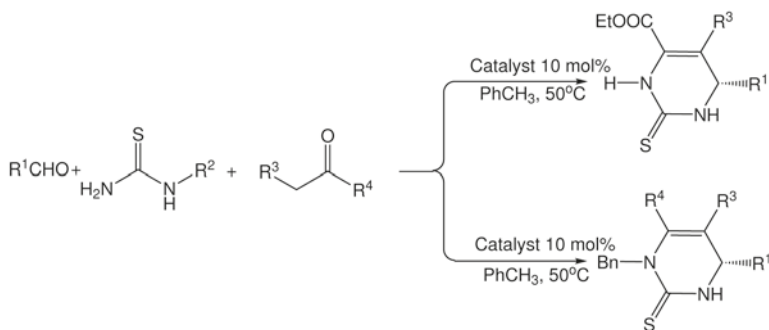
PHOSPHORUS - Ligands and Compounds

15-0340 (R)-(-)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl- 2,2'-diyl hydrogen phosphate, min. 98% (continued) [(R)-TiPSY] (791616-55-2)

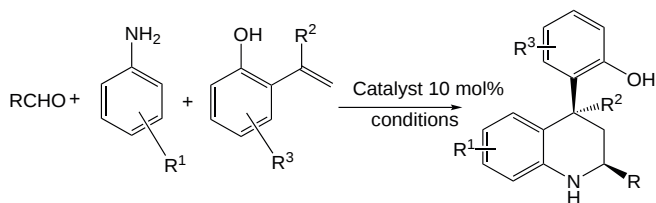
3. Chiral phosphoric acid organocatalyst used in the asymmetric, three-component Povarov reaction involving 2-hydroxystyrenes. An efficient method to access structurally diverse *cis*-disubstituted tetrahydroquinolines in high stereoselectivities of up to >99:1 dr and 97% ee.
4. A gold/chiral phosphoric acid catalyst used for the highly stereoselective, three-component reaction of salicylaldehydes, anilines, and alkynols to give aromatic spiroacetals in high yields and stereoselectivities.
5. The first highly enantioselective catalytic protocol for the reductive coupling of ketones and hydrozones.
6. Reagent-controlled regioselectivity enabled by dual activation.



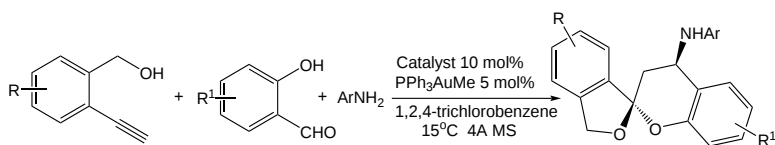
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



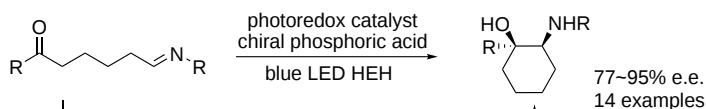
Tech. Note (3)
Ref. (3)



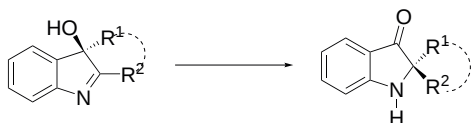
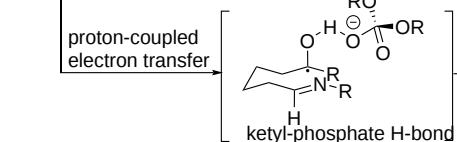
Tech. Note (4)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

15-0340 (R)-(-)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl- 2,2'-diyl hydrogen phosphate, min. 98%
(continued) [(R)-TiPSY] (791616-55-2)



Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)

References:

1. *J. Am. Chem. Soc.* **2006**, *128*, 84
2. *J. Am. Chem. Soc.* **2009**, *131*, 15301
3. *J. Am. Chem. Soc.* **2012**, *134*, 6970
4. *Org. Lett.*, **2013**, *15*, 460
5. *J. Am. Chem. Soc.* **2013**, *135*, 17735
6. *Eur. J. Organic Chem.*, **2017**, *2017*, 3134.

15-0341 (S)-(+)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl-2,2'-diyl hydrogen phosphate, min. 98% [(S)-TiPSY] (929097-92-7)

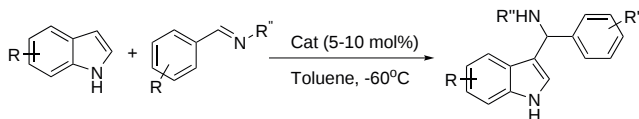
NEW

C₅₆H₄₁O₄PSi₂; FW: 865.07; white to light-yellow solid; m.p. 329-335°
Note: Sold in collaboration with Daicel for research purposes only.

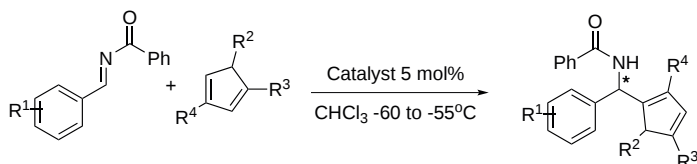
10mg
100mg

Technical Notes:

1. Chiral phosphoric acid catalyst used for the highly enantioselective Friedel-Crafts reaction of indoles with imines.
2. Chiral phosphoric acid catalyst used for the highly enantioselective Friedel-Crafts reaction of pyrrole derivatives with *N*-acyl imines.
3. Chiral phosphoric acid catalyst used for the enantioselective transfer hydrogenation of hydroxylactams providing enantio-enriched tetrahydro-β-carbolines (in dioxane) at room temperature (up to 94% yield, 90% ee).
4. [Rh₂(OAc)₄] chiral phosphonic acid catalyst used for the enantioselective symmetric, three-component reaction of diazo compounds with imines and water yielding β-amino-α-hydroxy acid derivatives.
5. Enantioselective desymmetrization of prochiral allenic diols via cooperative catalysis of Pd(OAc)₂ and a chiral phosphoric acid.



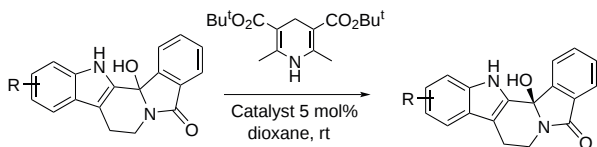
Tech. Note (1)
Ref. (1)



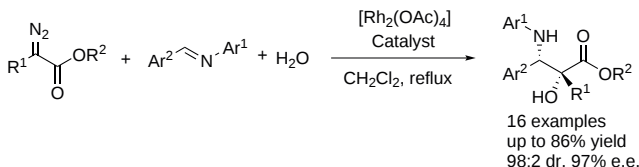
Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

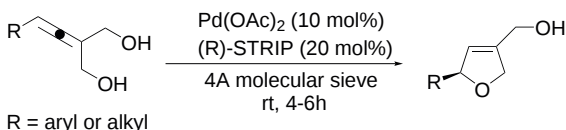
15-0341 (S)-(+)-3,3'-Bis(triphenylsilyl)-1,1'-binaphthyl-2,2'-diyl hydrogen phosphate, min. 98%
(continued) [(S)-TiPSY] (929097-92-7)



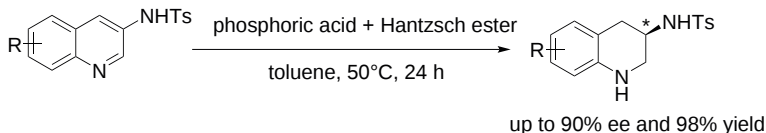
Tech. Note (3)
Ref. (3)



Tech. Note (3)
Ref. (3)



Tech. Note (5)
Ref. (5)

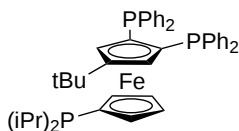


Tech. Note (6)
Ref. (6)

References:

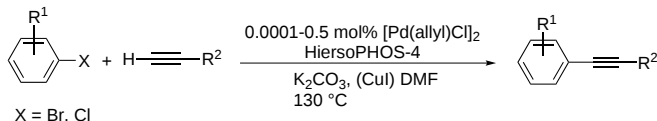
1. *J. Am. Chem. Soc.* **2007**, *129*, 1484
2. *Org. Lett.*, **2007**, *9*, 4065
3. *Org. Lett.*, **2013**, *15*, 2688
4. *ChemCatChem*, **2011**, *3*, 653
5. *Tetrahedron Asymmetry*, **2015**, *26*, 1150.
6. *New Journal of Chemistry*, **2016**, *40*, 9034.

15-0125	2-Bromophenyldiphenylphosphine, 98% (62336-24-7) C ₁₈ H ₁₄ BrP; FW: 341.18; white pwdr.	1g 5g
26-0324	4-(t-Butyl)-1,2-bis(diphenylphosphino)-1'-(di-i-propylphosphino)ferrocene, 98% HiersoPHOS-4 (776315-37-8) C ₄₄ H ₄₉ FeP ₃ ; FW: 726.63; orange xtl.	100mg 500mg



Technical Notes:

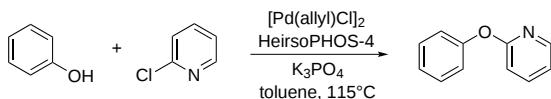
1. Ligand for the Sonogashira couplings of aryl halides at ultra-low catalyst loading
2. Ligand for the palladium catalysed C-O coupling of phenols with heteroaryl chlorides
3. Ligand for the Buchwald-Hartwig cross-coupling of aryl halides with arylamines



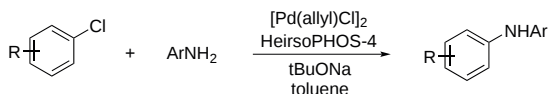
Tech. Note (1)
Ref. (1,2)

PHOSPHORUS - Ligands and Compounds

26-0324 4-(*t*-Butyl)-1,2-bis(diphenylphosphino)-1'-(di-*i*-propylphosphino)ferrocene, 98%
(continued) HiersoPHOS-4 (776315-37-8)



Tech. Note (2)
Ref. (3)



Tech. Note (3)
Ref. (4,5)

References:

1. *Org. Lett.*, **2004**, 6, 3473
2. *Organometallics*, **2010**, 29, 2815.
3. *Adv. Synth. Catal.*, **2011**, 353, 3403.
4. *Catal. Sci. Technol.*, **2014**, 4, 2072.
5. *Catal. Commun.*, **2014**, 51, 10.

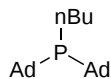
15-0483 Butyldi-1-adamantylphosphine, min. 95%

[cataCXium® A] (321921-71-5)

C₄H₉(C₁₀H₁₅)₂P; FW: 358.54; white to yellow powdr.;
m.p. 100°

air sensitive

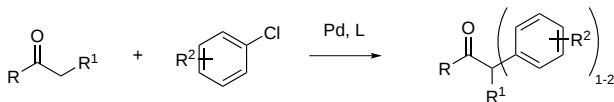
Note: Sold in collaboration with Solvias for research
purposes only. Patent WO 0210178. Solvias
cataCXium® Ligand Kit component.



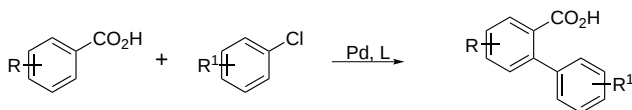
1g
5g

Technical Notes:

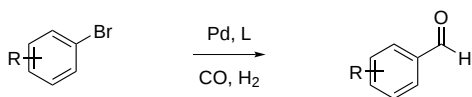
1. Ligand for the Pd-catalyzed Suzuki coupling reaction.
2. Ligand for the Pd-catalyzed formation of α -aryl ketones.
3. Ligand for the Pd-catalyzed aminations
4. Ligand for the Pd-catalyzed Heck reaction.
5. Ligand used for arylation of benzoic acids.
6. Ligand for the formylation of aryl bromides.
7. Ni-catalyzed denitrogenative alkyne insertion reactions of triazoles.
8. Ligand for palladium-catalyzed aminocarbonylation of aryl halides
9. Palladium-catalyzed direct arylation of oxazole at C-5 with aryl bromides, chlorides, and triflates
10. Palladium-catalyzed carbonylative sonogashira coupling of aryl bromides.
11. Selective palladium-catalyzed C-2 or C-5 direct arylation of SEM-imidazole.
12. Ligand for palladium-catalyzed cascade process consisting of isocyanide insertion and benzylic C(sp³)-H activation.
13. Ligand for palladium-catalyzed aryl borylation.



Tech. Note (2)
Ref. (2)



Tech. Note (5)
Ref. (5)



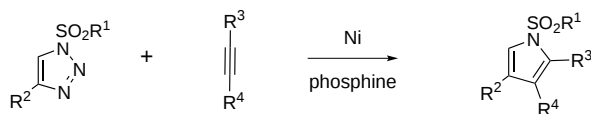
Tech. Note (6)
Ref. (6)

PHOSPHORUS - Ligands and Compounds

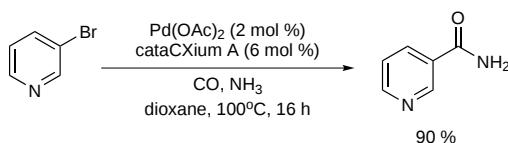
15-0483

Butyldi-1-adamantylphosphine, min. 95% [cataCXium® A] (321921-71-5)

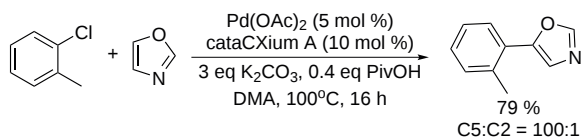
(continued)



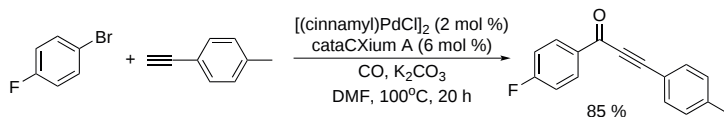
Tech. Note (7)
Ref. (7)



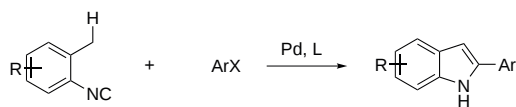
Tech. Note (8)
Ref. (8)



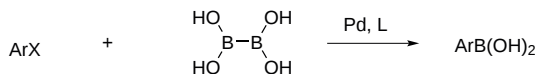
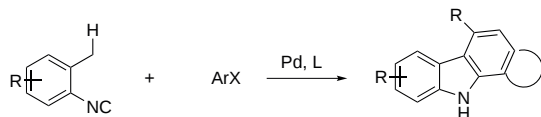
Tech. Note (9)
Ref. (9)



Tech. Note (10)
Ref. (10)



Tech. Note (12)
Ref. (12)

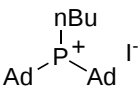
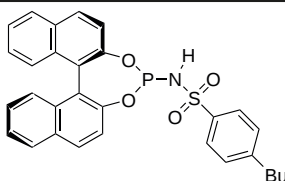


Tech. Note (13)
Ref. (13)

References:

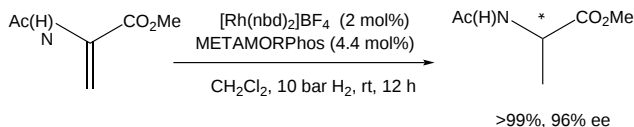
1. *Angew. Chem. Int. Ed.*, **2000**, 39, 4153.
2. *Adv. Synth. Catal.*, **2002**, 344, 209.
3. *J. Mol. Catal. A: Chemical*, **2002**, 182-183, 515.
4. *Synlett*, **2000**, 1589.
5. *J. Am. Chem. Soc.*, **2007**, 129, 9879.
6. *Angew. Chem., Int. Ed.*, **2006**, 45, 154.
7. *Chem. Commun.*, **2009**, 1470.
8. *Chem. Eur. J.*, **2010**, 16, 9750.
9. *Org. Lett.*, **2010**, 12, 3578.
10. *Chem. Eur. J.*, **2010**, 16, 12104.
11. *J. Org. Chem.*, **2010**, 75, 4911.
12. *Organic Letters*, **2012**, 14, 4270.
13. *J. Am. Chem. Soc.*, **2012**, 134, 11667.

PHOSPHORUS - Ligands and Compounds

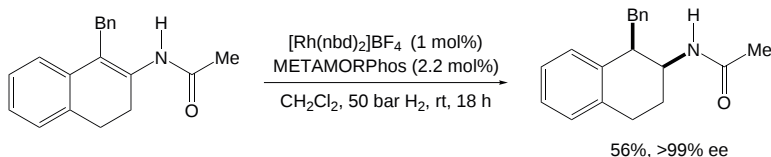
15-0495	n-Butyl-di-(1-adamantyl)phosphonium iodide, min. 95% [cataCXium® AHI] (714951-87-8) [(C ₄ H ₉)(C ₁₀ H ₁₅) ₂ PH] ⁺ I ⁻ ; FW: 486.45; white powdr. <i>light sensitive</i> Note: Sold in collaboration with Solvias for research purposes only. Patent US7148176. Solvias cataCXium® Ligand Kit component.		250mg 1g
15-0500 amp HAZ	t-Butyldichlorophosphine, 98% (25979-07-1) (CH ₃) ₃ CPCl ₂ ; FW: 159.00; white to pale yellow xtl.; m.p. 47-48°; b.p. 146-148° <i>air sensitive, moisture sensitive</i>		2g 10g
15-0540	t-Butyldicyclohexylphosphine, min. 95% (93634-87-8) [(CH ₃) ₃ C](C ₆ H ₁₁) ₂ P; FW: 254.40; colorless liq.; d. 0.939 <i>air sensitive</i>		500mg 2g
15-2218	4-Butyl-N-[(11bR)-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yl]benzenesulfonamide triethylamine adduct, min. 97% (1150592-91-8) C ₃₀ H ₂₆ NO ₃ PS·(CH ₃ CH ₂) ₃ N; FW: 527.57 (628.76); white powdr. <i>moisture sensitive, (store cold)</i> Note: Sold under license from InCatT for research purposes only. WO2009/065856. UREAPhos and METAMORPhos Ligand Kit component.		50mg 250mg

Technical Note:

- Chiral ligand for the rhodium-catalyzed asymmetric hydrogenation of α-β unsaturated substrates.



Tech. Note (1)
Ref. (1-3)



Tech. Note (1)
Ref. (1-3)

References:

- J. Am. Chem. Soc., **2009**, 131, 6683.
- Angew. Chem. Int. Ed., **2008**, 47, 3180.
- Patent WO2009065856.

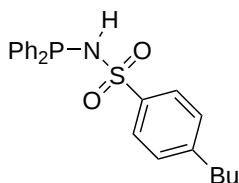
PHOSPHORUS - Ligands and Compounds

15-2220

4-Butyl-N-(diphenylphosphino)benzenesulfonamide, min. 97%
(1025096-61-0)

C₂₂H₂₆NO₂PS; FW: 397.47; white powdr.
moisture sensitive, (store cold)

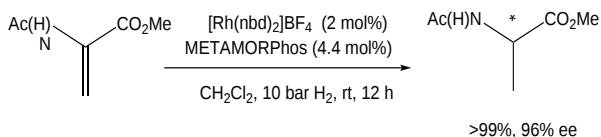
Note: Sold under license from
InCatT for research purposes only.
WO2009/065856. UREAPhos and
METAMORPhos Ligand Kit component.



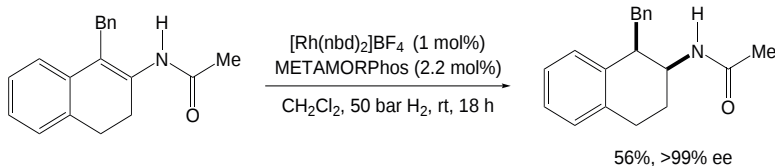
50mg
250mg

Technical Note:

- Chiral ligand for the rhodium-catalyzed asymmetric hydrogenation of α - β unsaturated substrates.



Tech. Note (1)
Ref. (1-3)



Tech. Note (1)
Ref. (1-3)

References:

- J. Am. Chem. Soc., **2009**, 131, 6683.
- Angew. Chem. Int. Ed., **2008**, 47, 3180.
- Patent WO2009065856.

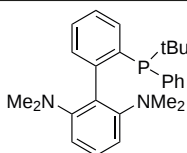
15-3010

NEW

2-(t-Butylphenylphosphino)-2',6'-dimethyl-amino-1,1'-biphenyl, 98% (t-Bu)PhCPhos
(1660153-91-2)

C₂₆H₃₃N₂P; FW: 404.53;
white to off-white powdr.

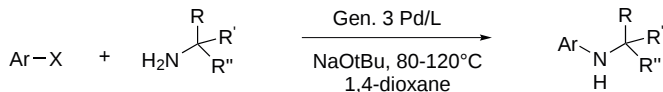
Note: Patents: US 6,395,916, US 6,307,087



250mg
1g
5g
25g

Technical Note:

- Ligand for the Palladium-catalyzed Buchwald-Hartwig cross-coupling of hindered primary amines and aryl halides



Tech. Note (1)
Ref. (1)

References:

- J. Am. Chem. Soc., **2015**, 137, 3085

15-0966

amp

HAZ



t-Butylphosphine, min. 95% TBP (2501-94-2)
(C₄H₉)PH₂; FW: 90.10; colorless liq.; b.p. 54°; d. 0.7
pyrophoric, STENCH

1g
5g

15-0967

HAZ

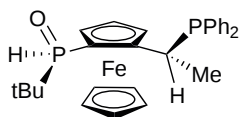
t-Butylphosphine, min. 95% TBP (10 wt% in hexanes) (2501-94-2)
(C₄H₉)PH₂; FW: 90.10; colorless liq.
air sensitive

10g
50g

PHOSPHORUS - Ligands and Compounds

26-1270

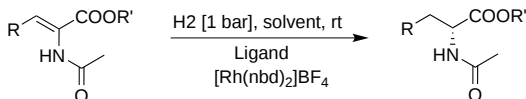
(R,S(p), R(SPO)-(1-t-Butylphosphinoyl)-2-[1-(diphenylphosphino)ethyl]ferrocene, min. 97% JoSPOphos (1221745-90-9)
 $C_{28}H_{32}FeOP_2$; FW: 502.35; orange powd.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only.



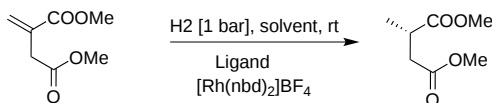
100mg
 500mg
 2g
 10g

Technical Notes:

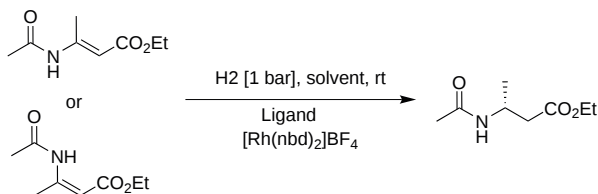
1. Ligand for Rh-catalyzed hydrogenation of vinylboronic esters.
2. Ligands used for the Ru-catalyzed asymmetric hydrogenation of β -ketoesters.
3. Ligands used for the Rh-catalyzed asymmetric hydrogenation of α -ketoesters.
4. Ligand for the highly selective coupling of benzotriazoles with allenes.



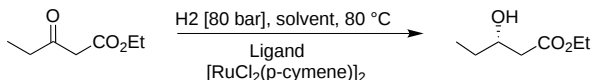
Tech. Note (1)
 Ref. (1)



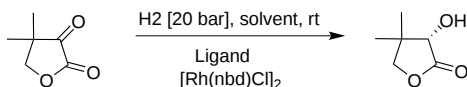
Tech. Note (1)
 Ref. (1)



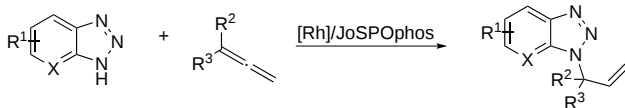
Tech. Note (1)
 Ref. (1)



Tech. Note (2)
 Ref. (1)



Tech. Note (3)
 Ref. (1)



Tech. Note (4)
 Ref. (1)

References:

1. *Angew. Chem. Int. Ed.*, **2010**, 49, 6873.
2. *Angew. Chem. Int. Ed.*, **2014**, 53, 7268.

26-1271

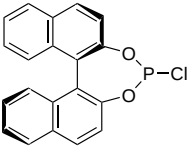
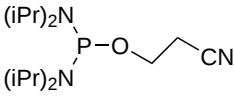
(S, R(p), S(SPO)-(1-t-Butylphosphinoyl)-2-[1-(diphenylphosphino)ethyl]ferrocene, min. 97% JoSPOphos (1221746-31-1)
 $C_{28}H_{32}FeOP_2$; FW: 502.35; orange powd.
 (store cold)
 Note: Sold in collaboration with Solvias for research purposes only.

100mg
 500mg
 2g
 10g

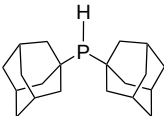
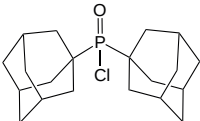
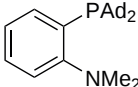
Technical Note:

1. See 26-1270 (page 129)

PHOSPHORUS - Ligands and Compounds

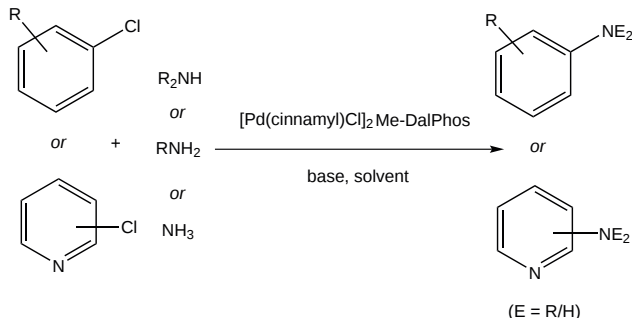
15-0690	Chloro(t-butyl)phenylphosphine, 97% (29949-69-7) C ₁₀ H ₁₄ ClP; FW: 200.65; colorless liq. <i>air sensitive, moisture sensitive</i>	1g 5g
		
HAZ		
15-0685	(R)-(-)-4-Chlorodinaphthol[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, min. 97% (155613-52-8) C ₂₀ H ₁₂ ClO ₂ P; FW: 350.74; white powdr. <i>moisture sensitive</i>	1g 5g
		
15-0686	(S)(+)-4-Chlorodinaphthol[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, min. 97% (137156-22-0) C ₂₀ H ₁₂ ClO ₂ P; FW: 350.74; white powdr. <i>moisture sensitive</i>	1g 5g
15-0695	2-Cyanoethyl N,N,N',N'-tetra(i-propyl)phosphorodiamidite, min. 98% (102691-36-1) {[(CH ₃) ₂ CH] ₂ N}POCH ₂ CH ₂ CN; FW: 301.41; colorless liq.; b.p. 100° (0.5mm); d. 0.949 <i>moisture sensitive, (store cold)</i>	1g 5g
		
15-0795	(2-Cyanophenyl)diphenylphosphine, min. 98% (34825-99-5) (NCC ₆ H ₄)(C ₆ H ₅) ₂ P; FW: 287.30; white to off-white powdr.; m.p. 148-150°	500mg 2g
15-1010	Cyclohexyl-di-t-butylphosphine, 97% (436865-11-1) [(CH ₃) ₃ C] ₂ (C ₆ H ₁₁)P; FW: 228.36; colorless liq. <i>air sensitive</i>	500mg 2g
15-1011	Cyclohexyl-di-t-butylphosphine, 98% (10wt% in hexanes) (436865-11-1) C ₁₄ H ₂₈ P; FW: 228.36; colorless liq. <i>air sensitive</i>	5g 25g
		
15-0800	Cyclohexyldichlorophosphine, 98% (2844-89-5) C ₆ H ₁₁ PCl ₂ ; FW: 185.03; colorless liq.; b.p. 100°/17mm <i>air sensitive, moisture sensitive</i>	1g 5g
15-0900	Cyclohexyldiphenylphosphine, 98% (6372-42-5) (C ₆ H ₁₁)(C ₆ H ₅) ₂ P; FW: 268.34; white xtl.; m.p. 58-62° <i>air sensitive</i>	1g 5g
15-0950	Cyclohexylphosphine, min. 97% (822-68-4) C ₆ H ₁₁ PH ₂ ; FW: 116.14; colorless liq.; b.p. 145°; d. 0.8750 <i>pyrophoric</i>	10g 50g
   		
15-0952	Cyclohexylphosphine, min. 97% (Sure/Seal™ bottle) (822-68-4) C ₆ H ₁₁ PH ₂ ; FW: 116.14; colorless liq.; b.p. 145°; d. 0.8750 <i>pyrophoric</i>	50g
  		
15-0953	Cyclohexylphosphine, min. 97% (10 wt% in hexanes) (822-68-4) C ₆ H ₁₁ PH ₂ ; FW: 116.14; colorless liq.; d. 0.684 <i>air sensitive</i>	100g
15-0958	n-Decylphosphonic acid, min. 97% (6874-60-8) CH ₃ (CH ₂) ₉ P(O)(OH) ₂ ; FW: 222.26; white to off-white powdr.; m.p. 103-104° Note: Long-Chain n-Alkylphosphonic Acid Kit component.	1g 5g
15-1095	Di-1-adamantylchlorophosphine, min. 97% (157282-19-4) (C ₁₀ H ₁₆) ₂ ClP; FW: 336.88; white solid <i>moisture sensitive</i>	250mg 1g
HAZ		

PHOSPHORUS - Ligands and Compounds

15-0954	Di-1-adamantylphosphine, min. 97% (131211-27-3) (C ₁₀ H ₁₅) ₂ PH; FW: 302.43; white powdr. <i>air sensitive</i>		250mg 1g
15-0956	Di-1-adamantylphosphine oxide, min. 90% (131266-79-0) (C ₁₀ H ₁₅) ₂ P(O)H; FW: 318.43; white powdr.		250mg 1g
15-0955	Di-1-adamantylphosphinic chloride, 98% (126683-99-6) (C ₁₀ H ₁₅) ₂ POCl; FW: 352.88; white xtl.; m.p. 214° <i>moisture sensitive</i>		250mg 1g
15-1090	2-(Di-1-adamantylphosphino) dimethylaminobenzene, 97% Me-DalPhos (1219080-77-9) C ₂₈ H ₄₀ NP; FW: 421.60; white to yellow xtl. <i>air sensitive</i>		250mg 1g

Technical Note:

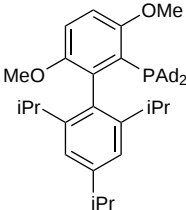
- Versatile ligand for the palladium-catalyzed amination of aryl and heteroaryl chlorides with primary aryl and alkylamines, cyclic and acyclic amines, lithium amide, N-H imines, hydrazones and ammonia.



Tech. Note (1)
Ref. (1)

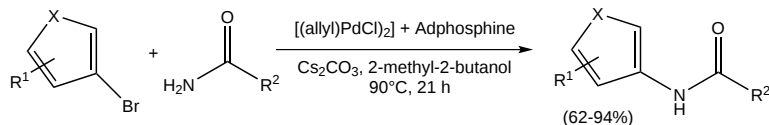
References:

- Chem. Eur. J.*, **2010**, 16, 1983.

15-1138	2-(Di-1-adamantylphosphino)-3,6-dimethoxy-2',4',6'-tri-<i>i</i>-propyl-1,1'-biphenyl, min. 95% AdBrettPhos (1160861-59-5) C ₄₃ H ₆₁ O ₂ P; FW: 640.92; off-white to pale yellow powdr. Note: Buchwald Biaryl Phosphine Ligand Master Kit component. Buchwald Biaryl Phosphine Ligand Mini Kit 1 component. Patents: US 6,395,916, US 6,307,087.		100mg 500mg 2g
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Technical Note:

- Ligand used in the palladium-catalyzed amidation of five-membered heterocycles as electrophiles.



Tech. Note (1)
Ref. (1)

References:

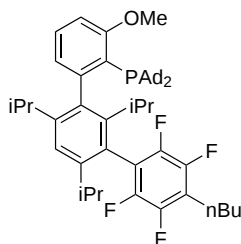
- J. Am. Chem. Soc.*, **2012**, 134, 19922.

PHOSPHORUS - Ligands and Compounds

15-2065

NEW

2-(Diadamantylphosphino)-3-methoxy-2',4',6'-tri-*i*-propyl-3'-(2,3,5,6-tetrafluoro-4-butyphenyl)-1,1'-biphenyl AlPhos
(1805783-60-1)
 $C_{52}H_{67}F_4OP$; FW: 815.06;
white to yellow powdr.
air sensitive
Note: Patents: US 6,395,916, US 6,307,087



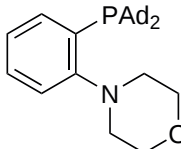
100mg
500mg
2g

Technical Note:

1. Visit strem.com for the full technical note of item 46-0241as a reference.

15-1092

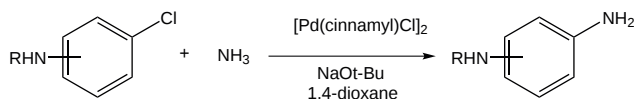
N-[2-(di-1-adamantylphosphino)phenyl]morpholine, 98% Mor-DalPhos
(1237588-12-3)
 $C_{30}H_{42}NOP$; FW: 463.63; white to yellow xtl.
air sensitive



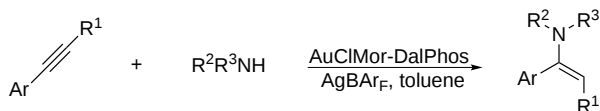
250mg
1g
5g

Technical Notes:

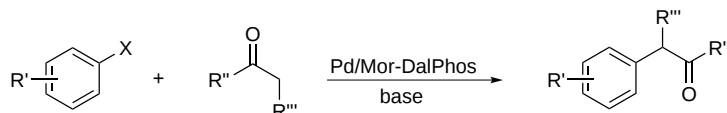
1. P-N-ligand for use in the Pd-catalyzed cross-coupling of ammonia and hydrazine. Ref. (2) with a diverse range of sterically hindered, unbiased aryl chlorides. Low catalyst loading and mild conditions. Ref (5) with diamines in a chemoselective arylation process. Ref (6) with solvent-free or aqueous conditions.
2. P-N-ligand for the gold-catalyzed stereoselective hydroamination of internal alkynes with dialkylamines to afford E-amines.
3. P-N-ligand for use in the Pd-catalyzed for mono- α -arylation of ketones employing aryl chlorides, bromides, iodides, mesylates (Ref. 7) and tosylates.



Tech. Note (1)
Ref. (1,2,5,6)



Tech. Note (2)
Ref. (3)



Tech. Note (3)
Ref. (4,7)

References:

1. *Angew. Chem. Int. Ed.*, **2010**, 49, 4071.
2. *Angew. Chem. Int. Ed.*, **2010**, 49, 8686.
3. *J. Am. Chem. Soc.*, **2010**, 132, 18026.
4. *J. Am. Chem. Soc.*, **2011**, 133, 5194.
5. *J. Org. Chem.*, **2012**, 77, 1056.
6. *Eur. J. Org. Chem.*, **2012**, 3972.
7. *Angew. Chem. Int. Ed.*, **2013**, 52, 7242.

15-0961

(1S,2S)-(-)-1,2-Diaminocyclohexane-N,N'-bis(2'-diphenylphosphinobenzoyl), 95% (S,S)-DACH-Phenyl Trost Ligand
(169689-05-8)
 $C_{44}H_{40}N_2O_2P_2$; FW: 690.76; white to off-white powdr.; m.p. 134-136°

100mg
500mg
2g

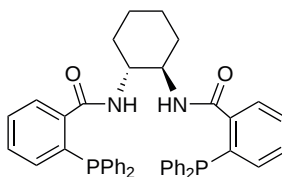
Technical Note:

1. See 15-0960 (page 133)

PHOSPHORUS - Ligands and Compounds

15-0960

(1*R*,2*R*)-(+)-1,2-Diaminocyclohexane- *N,N'*-bis(2'-diphenylphosphino-benzoyl), 98%
(*R,R*)-DACH-Phenyl Trost Ligand
(138517-61-0)
 $C_{44}H_{40}N_2O_2P_2$; FW: 690.76; white to off-white powdr.; m.p. 134-136°

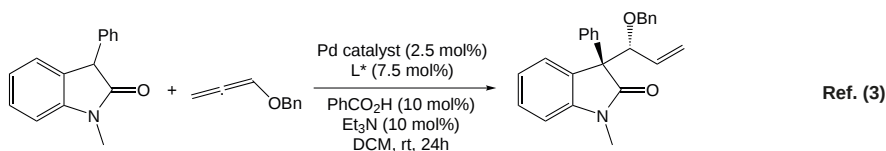
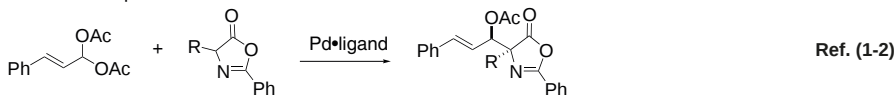


100mg
500mg
2g

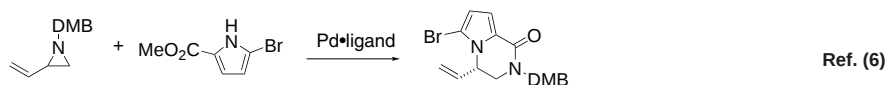
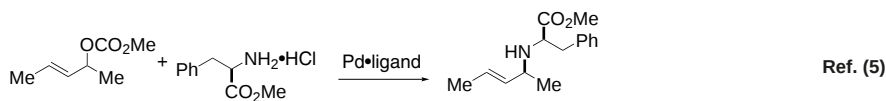
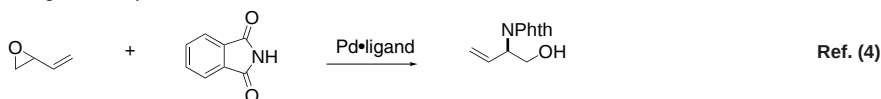
Technical Note:

- The palladium complexes of the Trost ligands are effective in a variety of allylic substitution reactions involving carbon, nitrogen, oxygen, sulfur, and fluorides nucleophiles.

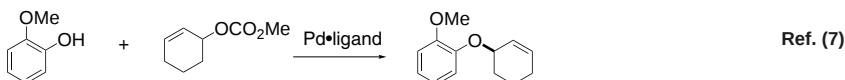
Carbon nucleophile



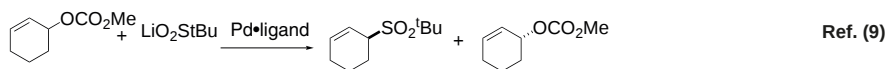
Nitrogen nucleophile



Oxygen nucleophile



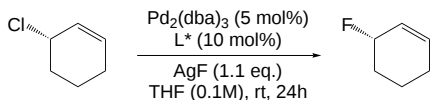
Sulfur nucleophile



PHOSPHORUS - Ligands and Compounds

15-0960 (1R,2R)-(+)-1,2-Diaminocyclohexane- N,N'-bis(2'-diphenylphosphinobenzoyl), 98%
(continued) (R,R)-DACH-Phenyl Trost Ligand (138517-61-0)

Fluoride nucleophile



Ref. (10)

References:

1. *Angew. Chem., Int. Ed.* **1997**, 36, 2635
2. *J. Am. Chem. Soc.* **1995**, 117, 7247
3. *J. Am. Chem. Soc.* **2011**, 133, 20611
4. *Angew. Chem., Int. Ed.* **1996**, 35, 99
5. *Org. Lett.*, **2007**, 9, 2357
6. *J. Am. Chem. Soc.*, **1998**, 120, 815
7. *J. Am. Chem. Soc.*, **2003**, 125, 6066
8. *Tetrahedron Lett.*, **2000**, 41, 3809
9. *J. Am. Chem. Soc.*, **2010**, 132, 17402

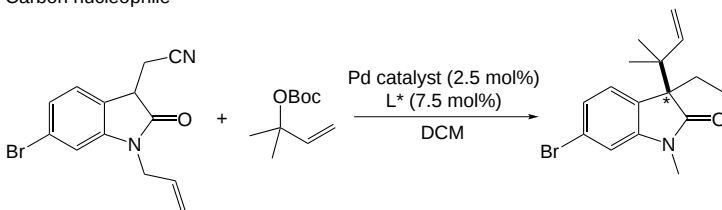
15-0963 (1R,2R)-(+)-1,2-Diaminocyclohexane-N,N'-bis(2-diphenylphosphino-1-naphthoyl), min. 94% (R,R)-DACH-Naphthyl Trost Ligand (174810-09-4)
 $C_{52}H_{44}N_2O_2P_2$; FW: 790.88; off-white powdr.

100mg
 500mg
 2g

Technical Note:

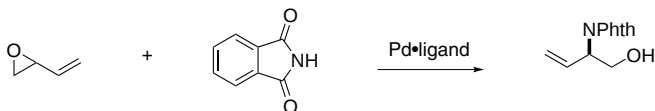
1. The palladium complexes of the Trost ligands are effective in a variety of allylic substitution reactions involving carbon, nitrogen, oxygen, and fluorides nucleophiles.

Carbon nucleophile

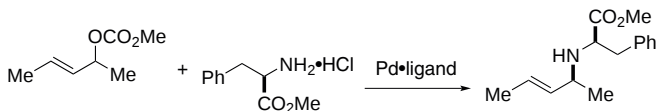


Ref. (1)

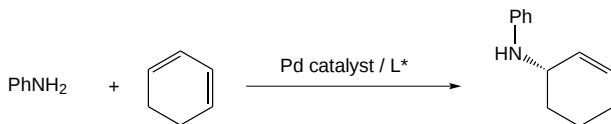
Nitrogen nucleophile



Ref. (2)



Ref. (3)

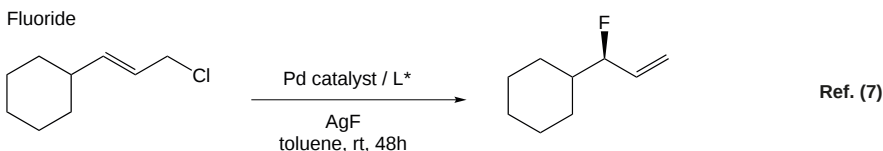
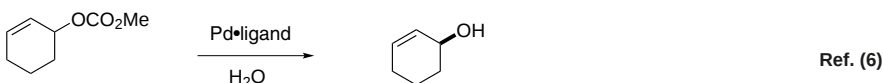
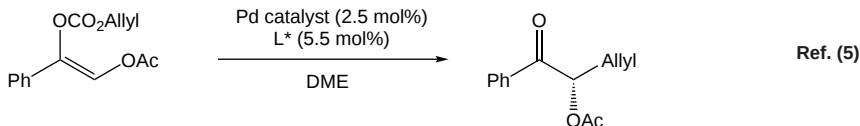


Ref. (4)

PHOSPHORUS - Ligands and Compounds

15-0963 (1R,2R)-(+)-1,2-Diaminocyclohexane-N,N'-bis(2-diphenylphosphino-1-naphthoyl), min.
(continued) 94% (R,R)-DACH-Naphthyl Trost Ligand (174810-09-4)

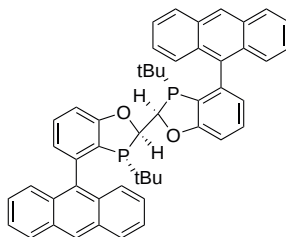
Oxygen nucleophile



References:

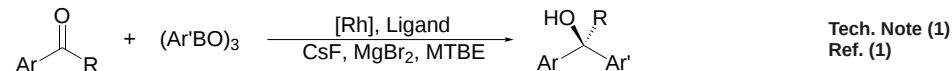
1. *J. Am. Chem. Soc.*, **2011**, 133, 7328.
2. *Angew. Chem., Int. Ed.*, **1996**, 35, 99.
3. *Tetrahedron Lett.*, **1998**, 39, 1713.
4. *J. Am. Chem. Soc.*, **2001**, 123, 4366.
5. *J. Am. Chem. Soc.*, **2008**, 130, 11852.
6. *J. Am. Chem. Soc.*, **2003**, 125, 6066.
7. *J. Am. Chem. Soc.*, **2011**, 133, 15902.

15-0964	(1S,2S)-(-)-1,2-Diaminocyclohexane-N,N'-bis(2-diphenylphosphino-1-naphthoyl), min. 94% (S,S)-DACH-Naphthyl Trost Ligand (205495-66-5) $C_{62}H_{44}N_2O_2P_2$; FW: 790.88; off-white powdr.	100mg 500mg 2g
15-1970 NEW	(2R,2'R,3R,3'R)-4,4'-Di(anthracen-9-yl)-3,3'-di-t-butyl-2,2',3,3'-tetrahydro-2,2'-bibenzo[d][1,3]oxaphosphole, min 98% (>90% ee), [(2R,2'R,3R,3'R)-WingPhos] (1884680-45-8) $C_{50}H_{44}O_2P_2$; FW: 738.83; light yello powdr. air sensitive, (store cold) Note: Sold in collaboration with Zejun for research purposes only. Patents ZL201310020371.1, CN 201610056390.	25mg 100mg 500mg



Technical Note:

1. Ligand for rhodium-catalyzed enantioselective addition of arylboroxines to simple aryl ketones.



References:

1. *Angew. Chem.Int Ed.*, **2016**, 55, 4527.

PHOSPHORUS - Ligands and Compounds

15-1975

NEW

(2S,2'S,3S,3'S)-4,4'-Di(anthracen-9-yl)-3,3'-di-t-butyl-2,2',3,3'-tetrahydro-2,2'-bibenzo[d][1,3]oxaphosphole, min 98%, (>99% ee), [(2S,2'S,3S,3'S)-WingPhos] (1435940-19-4)

C₅₀H₄₄O₂P₂; FW: 738.83; light yellow powdr.

air sensitive, (store cold)

Note: Sold in collaboration with Zejun for research purposes only.

Patents ZL201310020371.1, CN 201610056390.

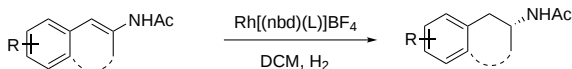
25mg

100mg

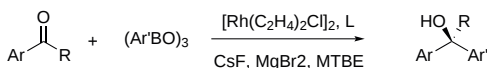
500mg

Technical Notes:

1. Ligand/Rhodium catalyst for asymmetric hydrogenation.
2. Ligand/Rhodium catalyst for asymmetric arylboronic reagents addition to aryl ketones.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

1. *Angew. Chem.Int.Ed.*, **2013**, 52, 4235.
2. *Angew. Chem.Int.Ed.*, **2016**, 55, 4527.

15-1157

2-Di[3,5-bis(trifluoromethyl)phenylphosphino]-3,6-dimethoxy-2',4',6'-tri-*i*-propyl-1,1'-biphenyl, min. 98% JackiePhos (1160861-60-8)

C₃₉H₃₇F₁₂O₂P₂; FW: 796.66; white xtl.;

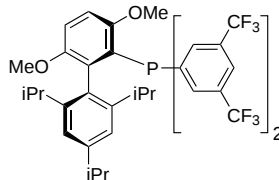
m.p. 185-190°

Note: Buchwald Biaryl Phosphine Ligand

Master Kit component.. Buchwald Biaryl

Phosphine Ligand Mini Kit 1 component..

Patents: US 6,395,916, US 6,307,087.



100mg

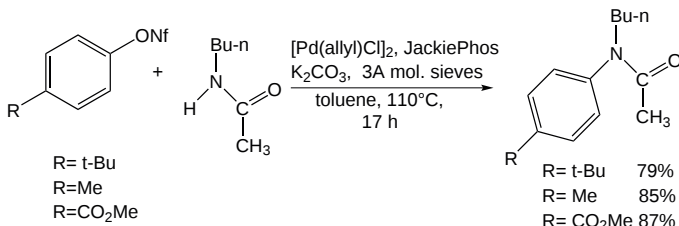
500mg

2g

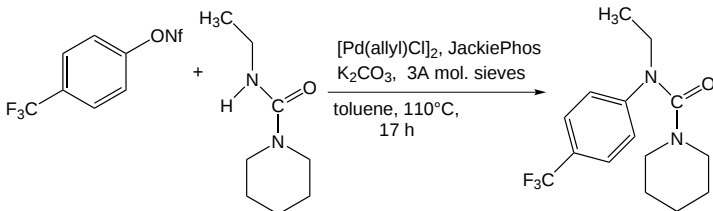
10g

Technical Notes:

1. Ligand used in the Pd-catalyzed coupling of aryl nonaflates and triflates with secondary amides.
2. Ligand used in the Pd-catalyzed coupling of aryl nonaflates and triflates with secondary ureas, carbamates, and sulfonamides.
3. Ligand used in the Pd-catalyzed coupling of aryl chlorides with secondary amides, carbamates, and sulfonamides.



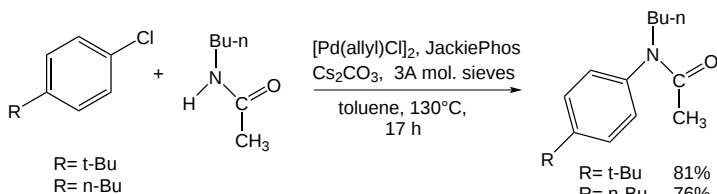
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-1157 **2-Di[3,5-bis(trifluoromethyl)phenyl]phenylphosphino]-3,6-dimethoxy-2',4',6'-tri-*i*-propyl-1,1'-bi-phenyl, min. 98% JackiePhos (1160861-60-8)**

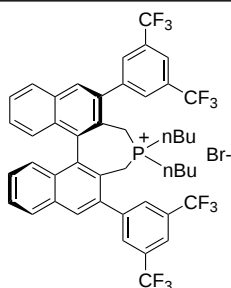


Tech. Note (3)
Ref. (1)

References:

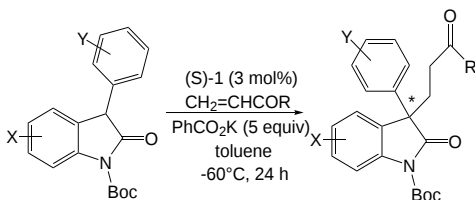
1. *J. Am. Chem. Soc.*, **2009**, *131*, 16720.

15-0990	Dibromotriphenylphosphorane, 98% (1034-39-5) (C ₆ H ₅) ₃ PBr ₂ ; FW: 422.10; light brown powdr. <i>air sensitive, moisture sensitive</i>	10g 50g
15-1457	(11bR)-(+)-4,4-Dibutyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% R-MARUOKA CAT P-NB [C ₄₆ H ₃₈ F ₁₂ P] ⁺ Br ⁻ ; FW: 929.65; white xtl.; m.p. 262-263° Note: Maruoka Chiral Phase-Transfer Phosphonium Organocatalyst Kit component.	50mg 250mg

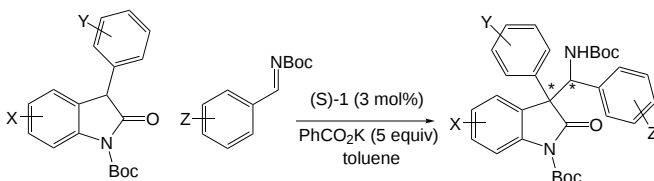


Technical Note:

1. Chiral, phase-transfer catalyst for the asymmetric Michael and Mannich reactions of 3-aryloxindoles.



Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)

References:

1. *Angew. Chem. Int. Ed.*, **2009**, *48*, 4559.

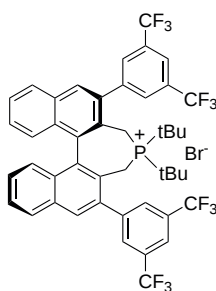
15-1458	(11bS)-(-)-4,4-Dibutyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% S-Maruoaka CAT P-NB (1110711-01-7) [C ₄₆ H ₃₈ F ₁₂ P] ⁺ Br ⁻ ; FW: 929.65; white xt.; m.p. 262-263° Note: Maruoka Chiral Phase-Transfer Phosphonium Organocatalyst Kit component.	50mg 250mg
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Technical Note:

1. See 15-1457 (page 137)

PHOSPHORUS - Ligands and Compounds

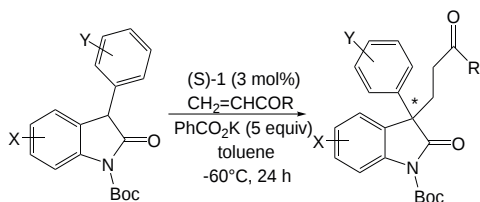
15-1464 (11bR)-(+)-4,4-Di-*t*-butyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% R-MARUOKA CAT P-TB
 $[C_{46}H_{38}F_{12}P]^+Br^-$; FW: 929.65; white xtl.; m.p. 202-204°
 Note: Maruoka Chiral Phase-Transfer Phosphonium Organocatalyst Kit component.



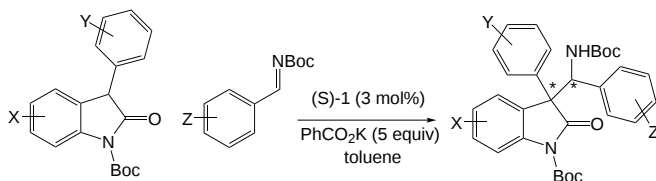
50mg
250mg

Technical Note:

- Chiral, phase-transfer catalyst for the asymmetric Michael and Mannich reactions of 3-aryloxindoles.



Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)

References:

- Angew. Chem. Int. Ed., 2009, 48, 4559.

15-1465 (11bS)-(-)-4,4-Di-*t*-butyl-2,6-bis[3,5-bis(trifluoromethyl)phenyl]-4,5-dihydro-3H-dinaphtho[2,1-c:1',2'-e]phosphepinium bromide, 99% S-MARUOKA CAT P-TB
 $[C_{46}H_{38}F_{12}P]^+Br^-$; FW: 929.65; white xtl.; m.p. 202-203°
 Note: Maruoka Chiral Phase-Transfer Phosphonium Organocatalyst Kit component.

50mg
250mg

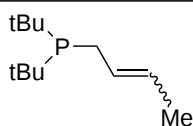
Technical Note:

- See 15-1464 (page 138)

15-1725 Di-*t*-butyl(2-butenyl)phosphine (40% in xylene), 98% m-Crophos®
 $C_{12}H_{25}P$; FW: 200.30; colorless liq.; b.p. 76-77° (4.0mm)
air sensitive

NEW

HAZ



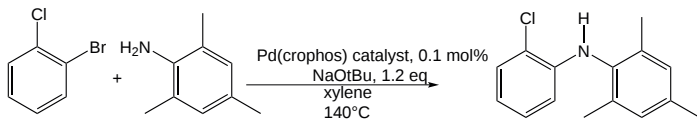
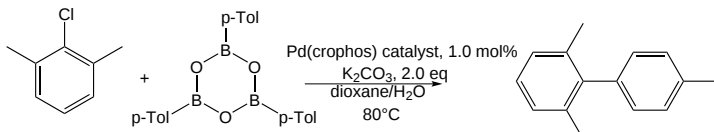
5g
25g
100g

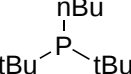
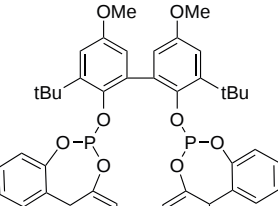
Technical Note:

- Crophos® is a very reactive phosphine ligand used in catalysts that are especially effective for coupling reactions involving bulky reactants.

PHOSPHORUS - Ligands and Compounds

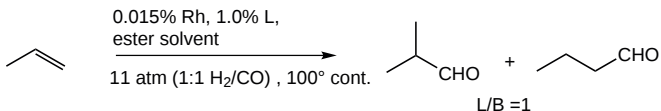
15-1725 Di-t-butyl(2-butenyl)phosphine (40% in xylene), 98% m-Crophos®
(continued)



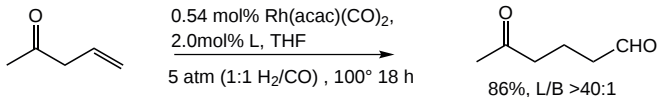
15-1128 amp HAZ 	Di-t-butyl(n-butyl)phosphine, min. 97% (29949-72-2) $C_{12}H_{27}P$; FW: 202.32; colorless liq. <i>air sensitive, pyrophoric</i>		250mg 1g 5g
15-1000 amp HAZ	Di-t-butylchlorophosphine, min. 98% (13716-10-4) $[(CH_3)_3C]_2PCl$; FW: 180.66; colorless to light yellow liq.; m.p. 2-3°; b.p. 69-70°/10 mm; f.p. 142°F; d. 0.951 <i>air sensitive, moisture sensitive</i>		1g 5g 25g
15-0107	6,6'-[(3,3'-Di-t-butyl-5,5'-dime-thoxy-1,1'-biphenyl-2,2'-diyl) bis(oxy) bis(dibenzo[d,f][1,3,2] dioxaphosphepin) hemi ethyl acetate adduct, min. 95% BIPHEPHOS (121627-17-6) $C_{46}H_{44}O_8P_2 \cdot 0.5EtOAc$; FW: 786.78 (830.84); white to off-white powdr.; m.p. 188-190° <i>air sensitive, moisture sensitive</i>		250mg 1g 5g

Technical Notes:

1. With rhodium forms a highly active catalyst for the hydroformylation of α -olefins.
2. The hydroformylation of functionalized α -olefins is highly regioselective. The sterically demanding ligand increases n/isio ratio by reducing rhodium interaction with heteroatom functionality.
3. Ligand used in tandem reaction sequences where high n/isio ratio is desired in the hydroformylation step.



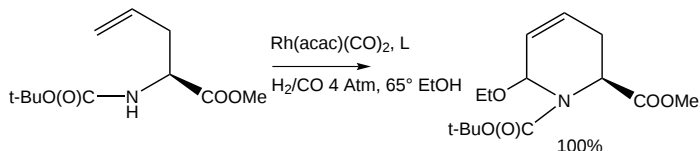
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2-4)

PHOSPHORUS - Ligands and Compounds

15-0107 6,6'-[(3,3'-Di-*t*-butyl-5,5'-dimethoxy-1,1'-biphenyl-2,2'-diyl)bis(oxy)] bis(dibenzo[d,f][1,3,2] dioxaphosphepin) hemi ethyl acetate adduct, min. 95% BIPHEPHOS (121627-17-6)

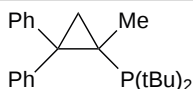


Tech. Note (3)
Ref. (5-7)

References:

1. US Patent 4769498.
2. *J. Am. Chem. Soc.*, **1993**, 115, 2066
3. *Organometallics*, **1995**, 14, 3832
4. *J. Mol. Catal. A*, **2005**, 232, 41
5. *J. Org. Chem.* **1995**, 60, 7078
6. *J. Org. Chem.* **2007**, 72, 1871
7. *Chem. Rev.* **1999**, 99, 3329

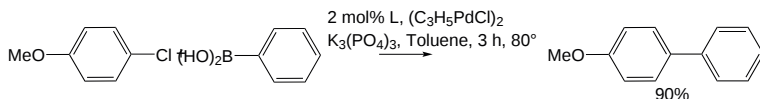
15-1005 Di-*t*-butyl(2,2-diphenyl-1-methyl-1-cyclopropyl)phosphine **cBRIDP** (742103-27-1)
C₂₄H₃₃P; FW: 352.49; white to pale yellow solid
air sensitive, (store cold)
Note: Manufactured under license of Takasago patent US7129367B2.



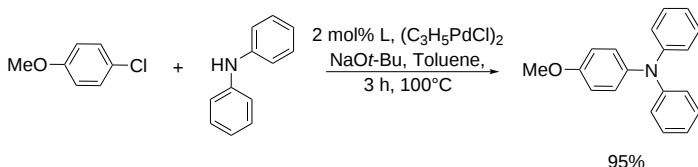
250mg
1g
5g

Technical Notes:

1. Ligand effective for many classes of palladium-catalyzed coupling of aryl halides, including the Miyaura-Suzuki, Buchwald-Hartwig, Sonogashira, Heck, aryl etherification, and carbonylation reactions.
2. Ligand used in the palladium catalyzed Suzuki-Miyaura coupling of aryl boronic acids.
3. Ligand employed in the palladium-catalyzed Buchwald-Hartwig aryl amination reaction.



Tech. Note (1,2)
Ref. (1,2)

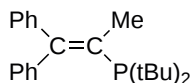


Tech. Note (1,3)
Ref. (1)

References:

1. US Patent 7129367.
2. *Synlett.*, **2008**, 12, 1809.

15-1065 Di-*t*-butyl(2,2-diphenyl-1-methylvinyl)phosphine, min. 98% **vBRIDP** (384842-25-5)
C₂₃H₃₁P; FW: 338.47; white to pale yellow xtl.
air sensitive, (store cold)
Note: Manufactured under license of Takasago patent US6455720.



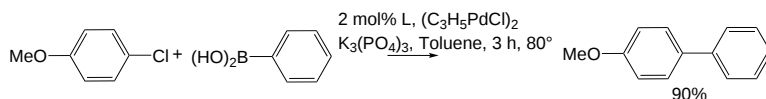
250mg
1g
5g

Technical Notes:

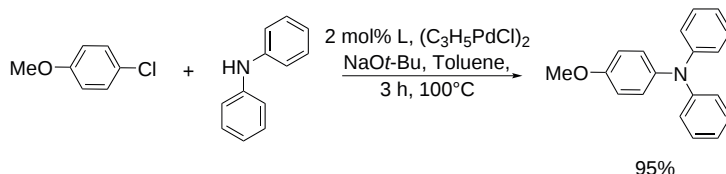
1. Ligand effective for many classes of palladium-catalyzed coupling of aryl halides, including the Miyaura-Suzuki, Buchwald-Hartwig, Sonogashira, Heck, aryl etherification, and carbonylation reactions.
2. Ligand used in the palladium catalyzed Suzuki-Miyaura coupling of aryl boronic acids.
3. Ligand employed in the palladium-catalyzed Buchwald-Hartwig aryl amination reaction.

PHOSPHORUS - Ligands and Compounds

15-1065 Di-*t*-butyl(2,2-diphenyl-1-methylvinyl)phosphine, min. 98% vBRIDP (384842-25-5)
(continued)



Tech. Note (1,2)
Ref. (1,2)



Tech. Note (1,2)
Ref. (1)

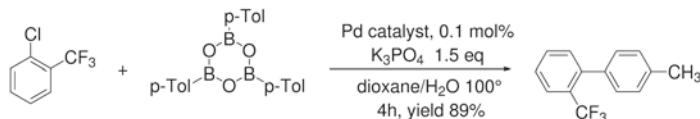
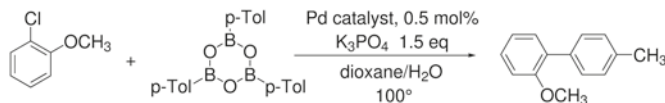
References:

- US Patent 7129367.
- Synlett., **2008**, 12, 1809.

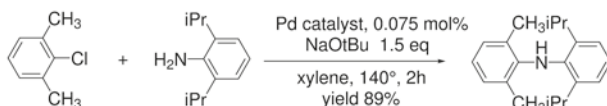
15-7230	Di-<i>t</i>-butyl(<i>n</i>-hexyl)phosphonium tetrafluoroborate, 98% C ₁₄ H ₃₂ BF ₄ P; FW: 318.18; white powdr. hygroscopic		500mg 2g
15-1729 NEW HAZ	Di-<i>t</i>-butyl(3-methyl-2-butenyl)phosphine (40% in xylene), 98% Crophos® C ₁₃ H ₂₇ P; FW: 214.33; colorless liq. air sensitive		5g 25g 100g

Technical Note:

- m*-Crophos® is a very reactive phosphine ligand used in catalysts that are especially effective for coupling reactions involving bulky reactants.



Tech. Note (1,2)
Ref. (1)



15-1020	Di-<i>t</i>-butylmethylphosphine, 98+% (6002-40-0)	1g
amp	[(CH ₃) ₃ C] ₂ (CH ₃)P; FW: 160.26; colorless liq.; d. 0.824	5g
HAZ	air sensitive	

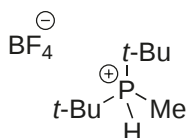
PHOSPHORUS - Ligands and Compounds

15-1023

Di-*t*-butylmethylphosphonium tetrafluoroborate, 99% (870777-30-3)

(C₄H₉)₂(CH₃)P⁺BF₄⁻; FW: 248.05; white powdr.

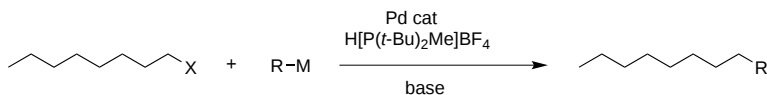
Note: Phosphine Ligand Kit component.



1g
5g

Technical Notes:

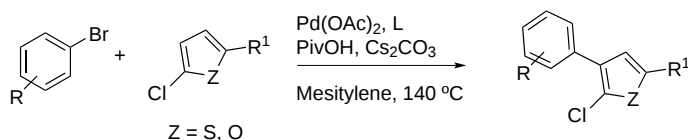
- Air and moisture-stable phosphonium salt used in palladium-catalyzed coupling reactions. The phosphonium salt is deprotonated in situ to yield the free phosphine ligand. Use of the phosphonium salt furnished nearly identical yields of product as reactions carried out using the phosphine.
- Ligand for the Pd-catalyzed heteroaromatic direct arylation.



Tech. Note (1)
Ref. (1-5)

X = I, Br, OTs

R = aryl, M = B(OH)₂, B_{pin}
R = vinyl, M = SnBu₃, Si(OMe)₃



Tech. Note (2)
Ref. (2-6)

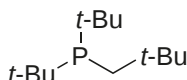
References:

- J. Am. Chem. Soc., **2003**, 125, 5616.
- J. Am. Chem. Soc., **2003**, 125, 3718.
- Angew. Chem. Int. Ed., **2002**, 41, 3910.
- J. Am. Chem. Soc., **2002**, 124, 13662.
- Angew. Chem. Int. Ed., **2011**, 50, 8660.
- J. Org. Chem., **2010**, 75, 1047.

15-1017

Di-*t*-butylneopentylphosphine, min. 95%
(DTBNpP) (60633-21-8)

(C₄H₉)₂(C₅H₁₁)P; FW: 216.35; colorless to yellow liq.
pyrophoric

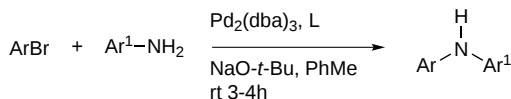


1g
5g

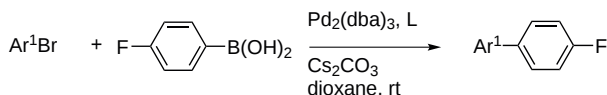


Technical Notes:

- The phosphine, used in combination with a palladium source, produces a highly effective catalyst for the Buchwald-Hartwig amination of aryl bromides at room temperature.
- Phosphine used in the palladium-catalyzed, Suzuki cross-coupling reaction.



Tech. Note (1)
Ref. (1,3)



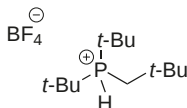
Tech. Note (2)
Ref. (2,3)

References:

- J. Org. Chem., **2006**, 71, 5117.
- Organometallics, **2006**, 25, 2978.
- J. Org. Chem., **2011**, 76, 7918.

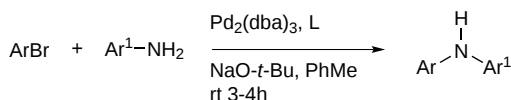
PHOSPHORUS - Ligands and Compounds

15-1018 HAZ	Di-t-butylneopentylphosphine, min. 95% (DTBNpP) (10 wt% in hexanes) (60633-21-8) (C ₄ H ₉) ₂ (C ₅ H ₁₁)P; FW: 216.35; colorless to pale yellow liq. <i>air sensitive</i>	10g 50g
15-1019	Di-t-butylneopentylphosphonium tetrafluoroborate, min. 95% (886059-84-3) [(C ₄ H ₉) ₂ (C ₅ H ₁₁)PH] ⁺ BF ₄ ⁻ ; FW: 304.17; white solid	1g 5g

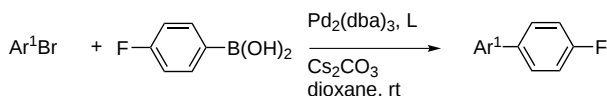


Technical Notes:

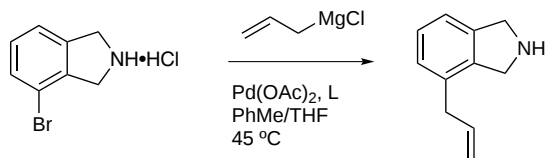
1. The phosphine, used in combination with a palladium source and base, produces a highly effective catalyst for the Buchwald-Hartwig amination of aryl bromides at room temperature.
2. Phosphine used in the palladium-catalyzed, Suzuki cross-coupling reaction.
3. Phosphine used in the palladium-catalyze Kumada cross-coupling reaction.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

1. J. Org. Chem., **2006**, 71, 5117.
2. Organometallics, **2006**, 25, 2978.
3. Org. Process Res. Dev., **2011**, 15, 158.

15-1093	Di-t-butylphenylphosphine, min. 98% (50wt% in toluene) (32673-25-9) C ₁₄ H ₂₃ P; FW: 222.31; colorless liq. <i>air sensitive</i>	2g 10g
15-1028	Di-t-butylphenylphosphonium tetrafluoroborate, 97% [[(CH ₃) ₃ Cl ₂ (C ₆ H ₅)PH] ⁺ BF ₄ ⁻ ; FW: 310.12; white pwdr.	1g 5g

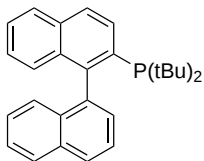
Technical Note:

1. Non-pyrophoric, air-stable derivative suitable as a replacement for the neat phosphine in a variety of stoichiometric and catalytic processes.

15-1030 amp HAZ 	Di-i-butylphosphine, min. 97% (4006-38-6) (C ₄ H ₉) ₂ PH; FW: 146.21; colorless liq.; f.p. -1°F <i>air sensitive, pyrophoric</i>	1g 5g 25g
15-1031 HAZ	Di-i-butylphosphine, min. 97% (10 wt% in hexanes) (4006-38-6) (C ₄ H ₉) ₂ PH; FW: 146.22; colorless liq. <i>air sensitive</i>	10g 50g 250g
15-1040 amp HAZ 	Di-t-butylphosphine, 98+% (819-19-2) [(CH ₃) ₃ Cl ₂ PH]; FW: 146.22; colorless liq.; m.p. -17°; b.p. 38-40°; f.p. -1°F; d. 0.790 <i>pyrophoric</i>	1g 5g 25g

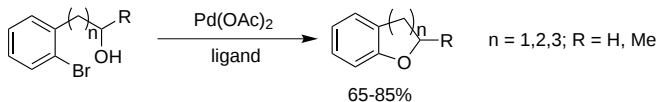
PHOSPHORUS - Ligands and Compounds

15-1042 HAZ	Di-t-butylphosphine, 98+% (10 wt% in hexanes) (819-19-2) [(CH ₃) ₃ C] ₂ PH; FW: 146.22; colorless liq. <i>air sensitive</i>	50g 250g
15-1041	Di-t-butylphosphine oxide, 98% (684-19-5) (C ₄ H ₉) ₂ P(O)H; FW: 162.21; white xtl. <i>hygroscopic</i>	250mg 1g
15-1043	racemic-2-Di-t-butylphosphino-1,1'-binaphthyl, 98% TrixiePhos (255836-67-0) C ₂₈ H ₃₁ P; FW: 398.53; white xtl.; m.p. 147-149° Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 2 component.. Patents: US 6,395,916, US 6,307,087.	250mg 1g 5g

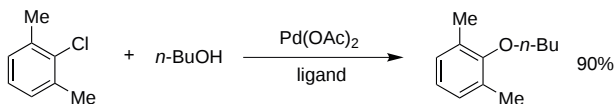


Technical Notes:

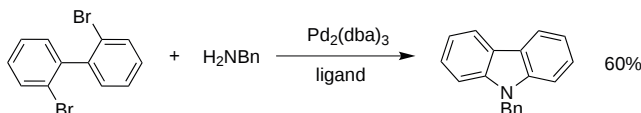
1. Ligand for the Pd-catalyzed formation of oxygen heterocycles.
2. Ligand for the intermolecular Pd-catalyzed synthesis of aryl ethers.
3. Ligand for the intramolecular Pd-catalyzed synthesis of aryl ethers.
4. Ligand for the synthesis of carbazoles by Pd-catalyzed double N-arylation reaction.
5. Ligand for the Pd-catalyzed cyanation of (hetero)arylchlorides.
6. Ligand for the Pd-catalyzed intramolecular synthesis of carbazoles via C-H functionalization.



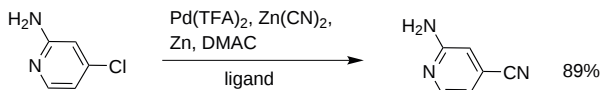
Tech. Note (1)
Ref. (1)



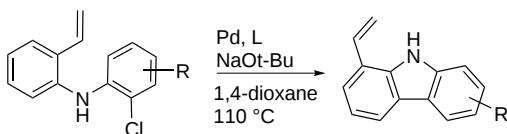
Tech. Note (2,3)
Ref. (2,3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



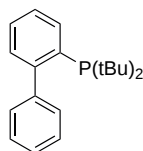
Tech. Note (6)
Ref. (6)

References:

1. J. Am. Chem. Soc., **2000**, 122, 12907.
2. J. Am. Chem. Soc., **2001**, 123, 10770.
3. J. Am. Chem. Soc., **2001**, 123, 12202.
4. Tetrahedron, **2006**, 62, 6792.
5. Org. Lett., **2007**, 9, 1711.
6. J. Am. Chem. Soc., **2010**, 132, 14048.
7. Chem. Sci., **2011**, 2, 27-50.

PHOSPHORUS - Ligands and Compounds

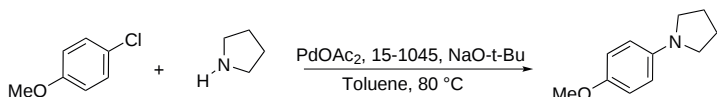
15-1045 **2-(Di-*t*-butylphosphino))-1,1'-biphenyl, 99%**
JohnPhos (224311-51-7)
 $C_{20}H_{27}P$; FW: 298.41; white xtl.; m.p. 85°
 Note: Phosphine Ligand Kit component. Note:
 Buchwald Biaryl Phosphine Ligand Master Kit
 component. Buchwald Biaryl Phosphine Ligand
 Mini Kit 2 component. Patents: US 6,395,916, US
 6,307,087.



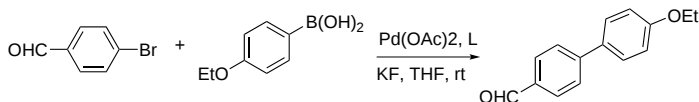
500mg
 2g
 10g
 50g

Technical Notes:

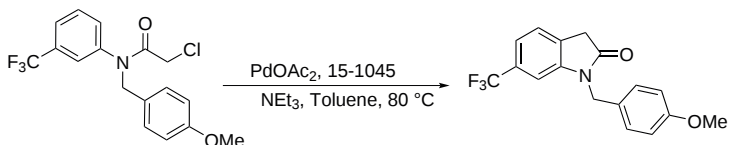
- Ligand used in the palladium-catalyzed synthesis of aromatic amines from aryl chlorides, bromides and triflates.
- Ligand employed in a very active and general catalyst for Suzuki coupling reactions using aryl chlorides, bromides and triflates.
- Ligand used in palladium-catalyzed synthesis of oxindoles from α -chloroacetanilides.
- Effective ligand used in palladium-catalyzed arylation of thiazoles.
- Used in the formation of 2-benzylindolines via sequential palladium-catalyzed N-arylation/cyclization/C-arylation.
- Selective in the palladium-catalyzed arylation of silyl enol ethers formed from copper-catalyzed reduction of enones.
- Ligand used in the palladium-catalyzed vinylation of aryl bromides.
- Ligand used in the platinum-catalyzed synthesis of indolizinones.
- Ligand used in the palladium-catalyzed diarylation of thiophenes.
- Ligand used in the amination of vinyl halides by carbazates.
- Ligand used in the regioselective synthesis of 2,4-disubstituted syloles.
- Ligand used in the gold-catalyzed hydrophenoxylation of phenols with diphenylacetylene.
- Ligand used in the palladium-catalyzed tandem allenyl and aryl C-N bond formation.
- Ligand used in the copper-catalyzed electrophilic amination of arylsilanes with hydroxylamines.



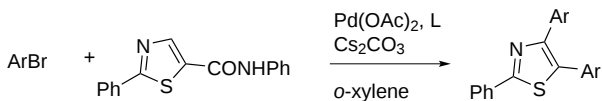
Tech. Note (1)
Ref. (2)



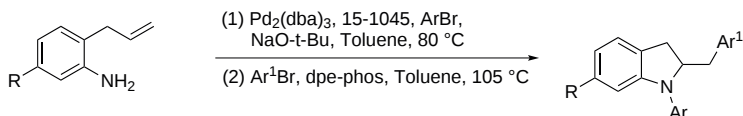
Tech. Note (2)
Ref. (3)



Tech. Note (3)
Ref. (4-5)



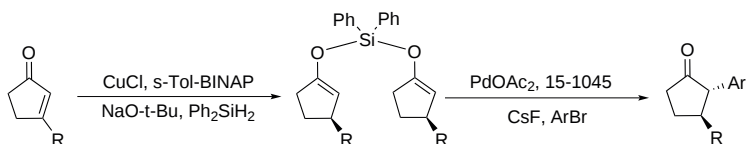
Tech. Note (4)
Ref. (6)



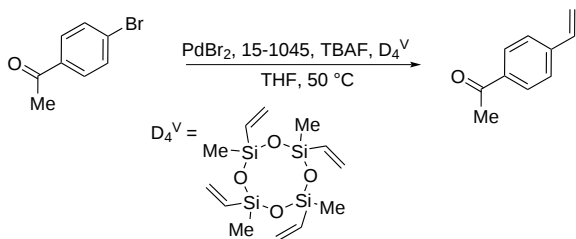
Tech. Note (5)
Ref. (7)

PHOSPHORUS - Ligands and Compounds

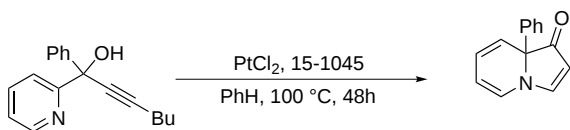
15-1045 2-(Di-*t*-butylphosphino))-1,1'-biphenyl, 99% JohnPhos (224311-51-7)
(continued)



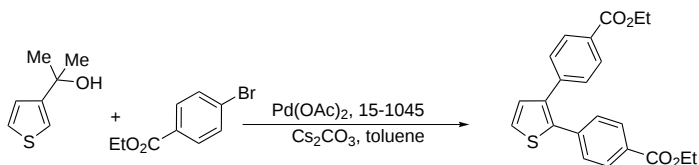
Tech. Note (6)
Ref. (8)



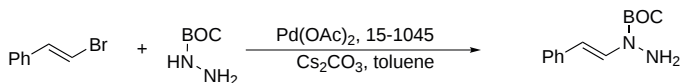
Tech. Note (7)
Ref. (9)



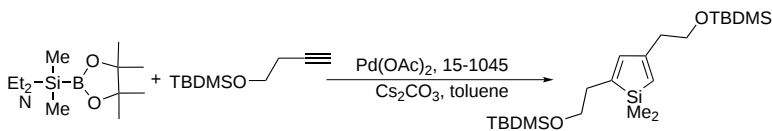
Tech. Note (8)
Ref. (10)



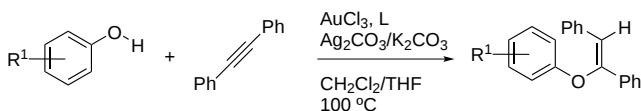
Tech. Note (9)
Ref. (11)



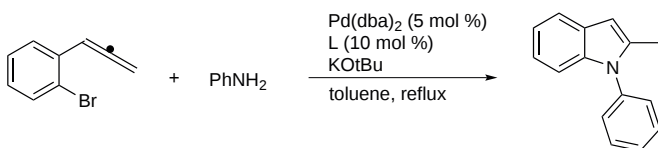
Tech. Note (10)
Ref. (12)



Tech. Note (11)
Ref. (13)



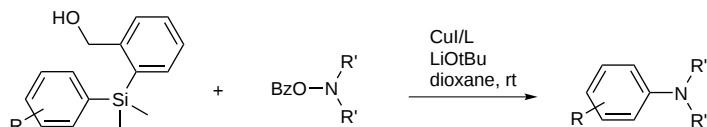
Tech. Note (12)
Ref. (14)



Tech. Note (13)
Ref. (16)

PHOSPHORUS - Ligands and Compounds

15-1045 2-(Di-*t*-butylphosphino))-1,1'-biphenyl, 99% JohnPhos (224311-51-7)
(continued)

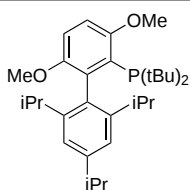


Tech. Note (14)
Ref. (17)

References:

1. *Angew. Chem. Int. Ed.*, **1999**, 38, 2413.
2. *J. Org. Chem.*, **2000**, 65, 1158.
3. *J. Am. Chem. Soc.*, **1999**, 121, 9550.
4. *J. Am. Chem. Soc.*, **2003**, 125, 12084.
5. *Org. Process Res. Dev.*, **2012**, 16, 255.
6. *Tetrahedron*, **2003**, 59, 5685.
7. *J. Am. Chem. Soc.*, **2004**, 126, 13906.
8. *Org. Lett.*, **2004**, 6, 4809.
9. *Org. Lett.*, **2006**, 7, 63.
10. *Org. Lett.*, **2007**, 9, 1169.
11. *J. Org. Chem.*, **2006**, 71, 8309.
12. *Org. Lett.*, **2007**, 9, 275.
13. *J. Am. Chem. Soc.*, **2008**, 130, 1526.
14. *J. Org. Chem.*, **2010**, 75, 2247.
15. *Chem. Sci.*, **2011**, 2, 27-50.
16. *Org. Lett.*, **2012**, 14, 4398.
17. *Org. Lett.*, **2013**, 15, 172.

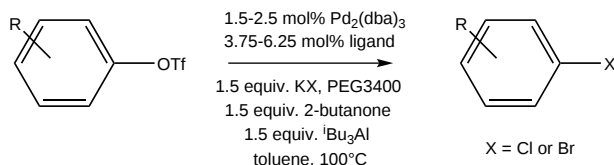
15-1164 2-(Di-*t*-butylphosphino)-3,6-dimethoxy-2',4',6'-tri-*i*-propyl-1,1'-biphenyl, min. 98% **t-BuBrettPhos** (1160861-53-9)
C₃₁H₄₉O₂P; FW: 484.69; white xtl.
Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 1 component..
Patents: US 6,395,916, US 6,307,087.



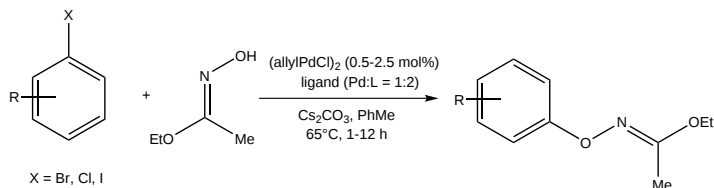
100mg
500mg
2g
10g
50g

Technical Notes:

1. Ligand used in the Pd-catalyzed conversion of aryl and vinyl triflates to bromides and chlorides.
2. Ligand used in the Pd-catalyzed O-arylation of ethyl acetohydroximates.
3. Ligand used in the Pd-catalyzed conversion of aryl chlorides, triflates, and nonaflates to nitroaromatics.
4. Ligand used in the Pd-catalyzed cross-coupling of amides and aryl mesylates.



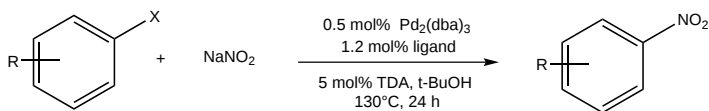
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

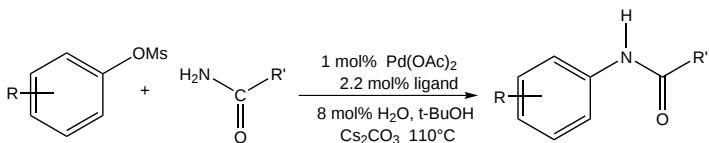
PHOSPHORUS - Ligands and Compounds

15-1164 **2-(Di-*t*-butylphosphino)-3,6-dimethoxy-2',4',6'-tri-*i*-propyl-1,1'-biphenyl, min. 98%**
(continued) **t-BuBrettPhos (1160861-53-9)**



X = Cl, triflate, nonaflates

Tech. Note (3)
Ref. (3)

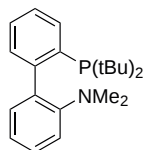


Tech. Note (4)
Ref. (4)

References:

1. *J. Am. Chem. Soc.*, **2010**, *132*, 14076.
2. *J. Am. Chem. Soc.*, **2010**, *132*, 9990.
3. *J. Am. Chem. Soc.*, **2009**, *131*, 12898.
4. *Org. Lett.*, **2010**, *12*(10), 2350.

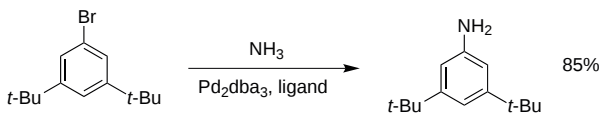
15-1048 **2-Di-*t*-butylphosphino-2'-(*N,N*-dimethylamino)-1,1'-biphenyl, 98% tBuDavePhos (224311-49-3)**
 (CH₃)₂NC₆H₄C₆H₄P(C₄H₉)₂; FW: 341.47; white xtl.
 Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 2 component.. Patents: US 6,395,916, US 6,307,087.



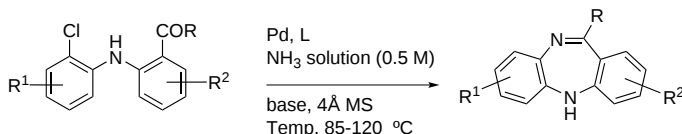
500mg
 2g
 10g

Technical Notes:

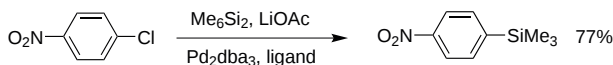
1. Useful ligand for Pd-catalyzed carbon-oxygen bond forming reactions.
2. Ligand used selective Pd-catalyzed arylation of ammonia. Application to the synthesis of dibenzodiazepines.
3. Ligand used for selective Pd-catalyzed silylation of aryl chlorides.
4. Ligand used for Pd(0)-catalyzed direct dehydrative coupling of terminal alkynes with allylic alcohols to access 1,4-enynes.



Tech. Note (2)
Ref. (2)



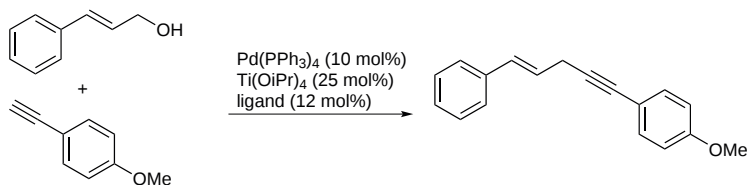
Tech. Note (2)
Ref. (3)



Tech. Note (3)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

15-1048 **2-Di-t-butylphosphino-2'-(N,N-dimethylamino)-1,1'-biphenyl, 98% tBuDavePhos**
(continued) **(224311-49-3)**



Tech. Note (4)
Ref. (6)

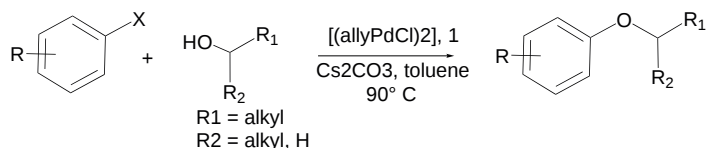
References:

1. *J. Am. Chem. Soc.*, **2001**, 123, 12202.
2. *J. Am. Chem. Soc.*, **2007**, 129, 10354.
3. *J. Am. Chem. Soc.*, **2011**, 133, 14228.
4. *Org. Lett.*, **2007**, 9, 3785.
5. *Chem. Sci.*, **2011**, 2, 27.
6. *J. Am. Chem. Soc.*, **2013**, 135, 12536.

15-7128 HAZ	2-(Di-t-butylphosphino)ethylamine, min. 97% (10 wt% in THF) (1053658-84-6) (tBu) ₂ P(CH ₂) ₂ NH ₂ ; FW: 189.28; pale yellow to colorless liq. <i>air sensitive, moisture sensitive</i>		5g 25g
15-1168	2-(Di-t-butylphosphino)-3-methoxy-6-methyl-2',4',6'-tri-i-propyl-1,1'-biphenyl, min. 98% RockPhos (1262046-34-3) C ₃₁ H ₄₉ OP; FW: 468.69; white xtl.; m.p. 129-130° Note: Patents: US 6,395,916, US 6,307,087.		100mg 500mg 2g

Technical Note:

1. Ligand used in the palladium-catalyzed C-O bond forming reactions of secondary and primary alcohols with a range of arylhalides. Heterocyclic halides and, for the first time, electron-rich aryl halides can be coupled with secondary alcohols.



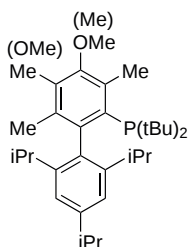
References:

1. *Angew. Chem. Int. Ed.*, **2011**, 50, 9943.

PHOSPHORUS - Ligands and Compounds

15-1063

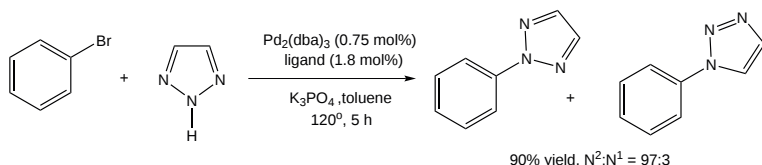
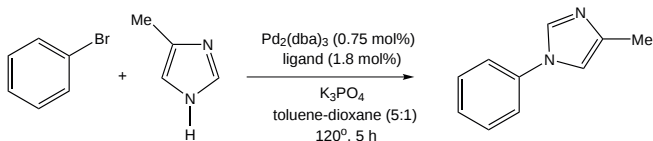
2-Di-t-butylphosphino-4-methoxy-3,5,6-trimethyl-2',4',6'-tri-i-propyl-1,1'-biphenyl, min. 98% [~1:1 mixture with regioisomer, 2-Di-t-butylphosphino-5-methoxy-3,4,6-trimethyl-2',4',6'-tri-i-propylbiphenyl] (1359986-21-2)
 $C_{33}H_{53}OP$; FW: 496.75; white powdr.
 Note: Patents: US 6,395,916, US 6,307,087



250mg
1g
5g

Technical Note:

1. A surrogate ligand for Me4tBuXPhos in palladium-catalyzed C-N and C-O bond-forming reactions.



Tech. Note (1)
Ref. (1)

References:

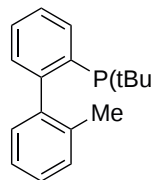
1. J. Org. Chem., 2012, 77, 2543.

15-1049

2-Di-t-butylphosphino-2'-methyl-1,1'-biphenyl, 99% t-BuMePhos (255837-19-5)

$C_{21}H_{29}P$; FW: 312.43; white xtl.

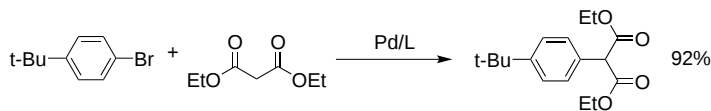
Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 2 component.. Patents: US 6,395,916, US 6,307,087.



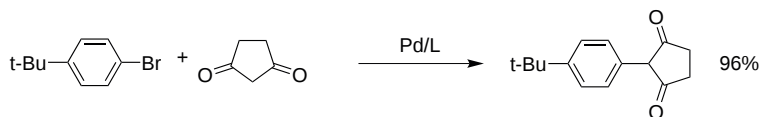
500mg
2g
10g
50g

Technical Notes:

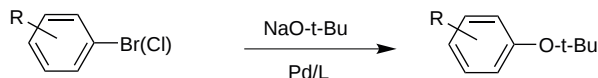
1. Ligand used in the Pd-catalyzed arylations of malonate esters and 1,3-diketones.
2. Ligand used in the Pd-catalyzed formation of t-butyl ethers from unactivated aryl halides.
3. Ligand used in the Pd-catalyzed α -arylations of nitroalkanes.



Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)

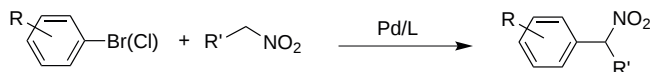


Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

15-1049 2-Di-t-butylphosphino-2'-methyl-1,1'-biphenyl, 99% t-BuMePhos (255837-19-5)

(continued)

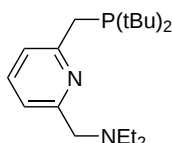


Tech. Note (3)
Ref. (3)

References:

1. *J. Am. Chem. Soc.*, **2000**, 122, 1360.
2. *J. Org. Chem.*, **2001**, 66, 2498.
3. *J. Org. Chem.*, **2002**, 67, 106.
4. *Chem. Sci.*, **2011**, 2, 27-50.

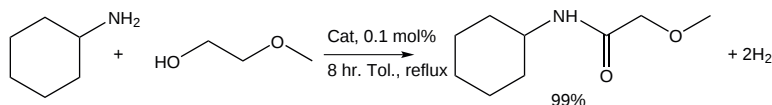
15-0073 2-(Di-t-butylphosphinomethyl)-6-(diethyl-aminomethyl)pyridine, 98% (863971-66-8)
C₁₉H₃₅N₂P; FW: 322.47; yellow liq.
air sensitive



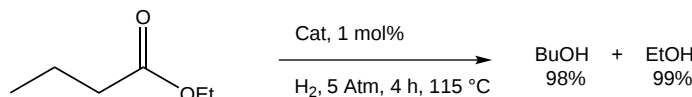
100mg
500mg

Technical Notes:

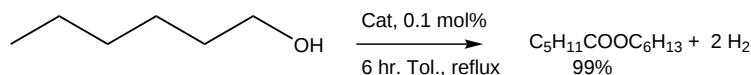
1. Ligand/Ruthenium catalyst for the direct synthesis of amides from alcohols and primary amines.
2. Ligand/ catalyst for the hydrogenation of esters in high yields under mild pressure and neutral conditions.
3. Ligand/Ruthenium catalyst for the dehydrogenative coupling of alcohols to form esters in high yields under neutral conditions
4. Ligand/Catalytic hydrogenation of dimethyl carbonate, methyl carbamates, and methyl formate, a route to methanol based on CO and CO₂.



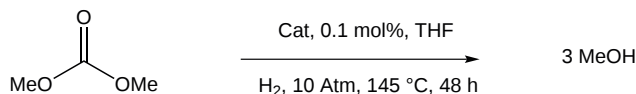
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3-4)

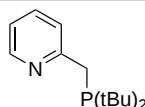


Tech. Note (4)
Ref. (5)

References:

1. *Science*, **2007**, 317, 790.
2. *Angew. Chem. Int. Ed.*, **2006**, 45, 1113.
3. *J. Am. Chem. Soc.*, **2005**, 127, 12429.
4. *J. Am. Chem. Soc.*, **2005**, 127, 10840.
5. *Nature, Chem.*, **2011**, 3, 609.
6. *Chem. Soc.*, **2005**, 127, 10840.

15-7350 2-(Di-t-butylphosphinomethyl)pyridine, 99%
(494199-72-3)
C₁₄H₂₄NP; FW: 237.32; pale yellow liq.
air sensitive



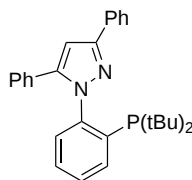
100mg
500mg

PHOSPHORUS - Ligands and Compounds

15-1720

NEW

1-(2-Di-t-butylphosphinophenyl)-3,5-diphenyl-1H-pyrazole, 98% (628333-86-8)
 $C_{25}H_{33}N_2P$; FW: 440.56; white xtl.; m.p. 138-142°
air sensitive

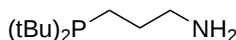


250mg
1g

15-7130

HAZ

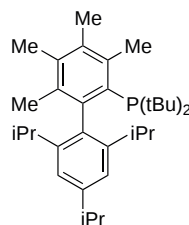
3-(Di-t-butylphosphino)propylamine, min. 97% (10 wt% in THF) (1196147-72-4)
 $C_{11}H_{26}NP$; FW: 203.30; pale yellow to colorless liq.
air sensitive



5g
25g

15-1051

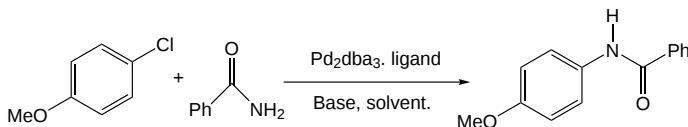
2-Di-t-butylphosphino-3,4,5,6-tetramethyl-2',4',6'-tri-i-propyl-1,1'-biphenyl, min. 98% Me₄t-BuXPhos (857356-94-6)
 $C_{33}H_{53}P$; FW: 480.75; white microxtl.; m.p. 166-168°
 Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 1 component.. Patents: US 6,395,916, US 6,307,087.



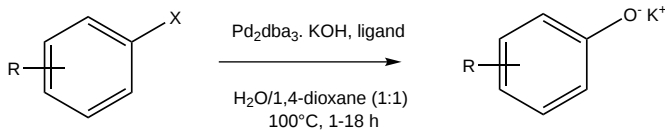
250mg
1g
5g
25g

Technical Notes:

1. Ligand for the palladium-catalyzed amidation of aryl chlorides.
2. Ligand for the palladium-catalyzed synthesis of phenols from aryl halides.
3. Ligand for the palladium-catalyzed coupling of aryl halides and secondary alcohols.

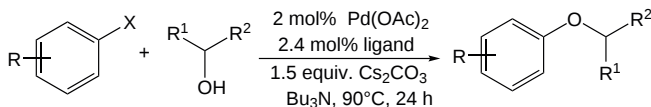


Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

X = Br, Cl



Tech. Note (3)
Ref. (3)

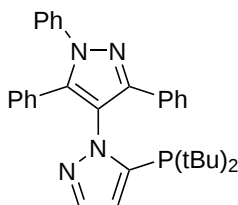
References:

1. *J. Am. Chem. Soc.*, **2007**, *129*, 13001.
2. *J. Am. Chem. Soc.*, **2006**, *128*, 10894.
3. *J. Am. Chem. Soc.*, **2005**, *127*, 8146.

PHOSPHORUS - Ligands and Compounds

15-1037

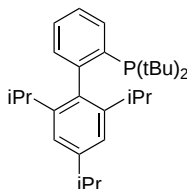
5-(Di-t-butylphosphino)-1',3',5'-triph-enyl-1,4'-bi-1H-pyrazole, min. 95% t-Bu-BippyPhos (894086-00-1)
 $C_{32}H_{35}N_4P$; FW: 506.62;
 white to pale yellow solid; m.p. 169-173°
air sensitive



250mg
1g

15-1052

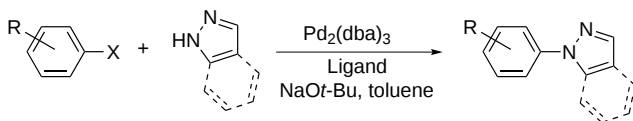
2-Di-t-butylphosphino-2',4',6'-tri-i-propyl-1,1'-biphenyl, min. 98% t-BuXPhos (564483-19-8)
 $C_{29}H_{45}P$; FW: 424.64; white xtl.;
 m.p. 147-149°
 Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 1 component..
 Patents: US 6,395,916, US 6,307,087.



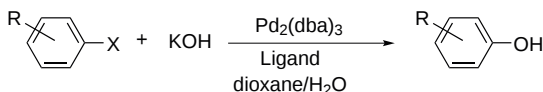
500mg
2g
10g
50g
250g

Technical Notes:

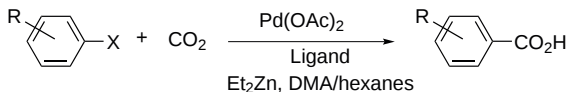
1. Effective ligand for the Pd-catalyzed arylation of pyrazoles, indazoles and amino heterocycles.
2. Ligand used in the Pd-catalyzed synthesis of phenols from aryl halides and KOH.
3. Ligand used in the Pd-catalyzed of benzoic acids from aryl halides and CO_2 .
4. Ligand used in the Pd-catalyzed trifluoromethylation of vinyl sulfonates.
5. Ligand used in the Pd-catalyzed arylation of nitroacetates.
6. Ligand used in the Pd-catalyzed Suzuki-Miyaura cross-coupling of allylboronates and aryl halides.
7. Ligand used in the Pd-catalyzed cyanation of (hetero)arylchlorides and bromides.
8. Ligand used in the Pd-catalyzed C-N cross coupling of sulfonamides and aryl halides.
9. Ligand used in the Pd-catalyzed arylation of cyanamides.



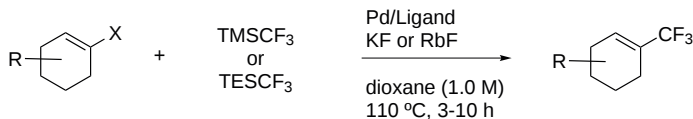
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

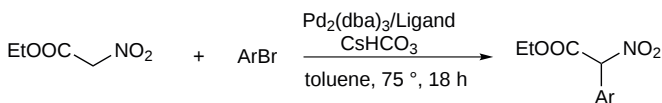


Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

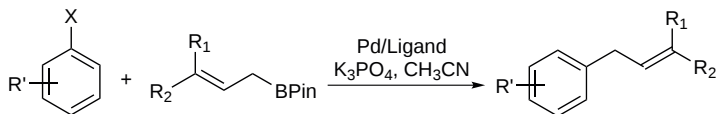
X = OTf or ONF



Tech. Note (5)
Ref. (5.6)

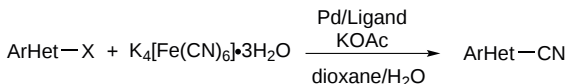
PHOSPHORUS - Ligands and Compounds

15-1052 2-Di-*t*-butylphosphino-2',4',6'-tri-*i*-propyl-1,1'-biphenyl, min. 98% *t*-BuXPhos (564483-19-8)
(continued)

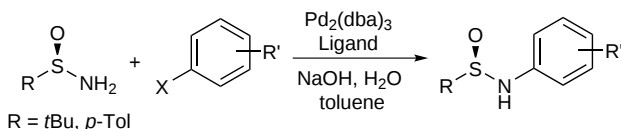


Tech. Note (6)
Ref. (7)

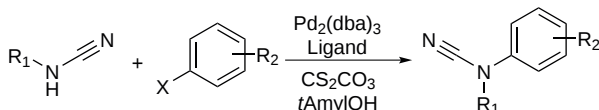
X = Cl, Br, OTf



Tech. Note (7)
Ref. (8)



Tech. Note (8)
Ref. (9)

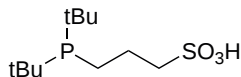


Tech. Note (9)
Ref. (10)

References:

1. *Angew. Chem., Int. Ed.*, **2006**, 45, 6523.
2. *J. Am. Chem. Soc.*, **2006**, 128, 10694.
3. *J. Am. Chem. Soc.*, **2009**, 131, 15974.
4. *Org. Lett.*, **2011**, 13, 6552.
5. *Chem. Sci.*, **2011**, 2, 27-50.
6. *Org. Lett.*, **2012**, 14, 760.
7. *J. Am. Chem. Soc.*, **2013**, 135, 10642.
8. *Angew. Chem., Int. Ed.*, **2013**, 52, 10035.
9. *J. Org. Chem.*, **2012**, 77, 4454.
10. *Org. Lett.*, **2012**, 14, 322.

93-1518	Di-<i>n</i>-butylphosphite, 96% (1809-19-4) (C ₄ H ₉ O) ₂ P(O)H; FW: 194.21; colorless liq.; b.p. 118-119°/11 mm; f.p. 250°F; d. 0.995	50g 250g
15-1054 HAZ 	Di-<i>t</i>-butyl(<i>i</i>-propyl)phosphine, min. 98% (25032-49-9) (C ₄ H ₉) ₂ (C ₃ H ₇)P; FW: 118.29; colorless liq. pyrophoric	250mg 1g
15-1067	Di-<i>t</i>-butyl(3-sulfonatopropyl)phosphine, min. 98% (1055888-89-5) (C ₄ H ₉) ₂ PCH ₂ CH ₂ CH ₂ SO ₃ H; FW: 268.35; white solid moisture sensitive	250mg 1g



PHOSPHORUS - Ligands and Compounds

15-1053

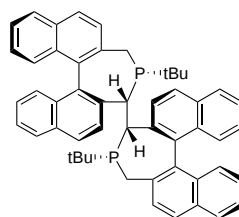
NEW

(3*S*,3'*S*,4*S*,4'*S*,11*bS*,11'*bS*)-(+)-4,4'-Di-*t*-butyl-4,4',5,5'-tetrahydro-3,3'-bi-3*H*-dinaphtho[2,1-*c*:1',2'-*e*]phosphepin, 97% (*S*)-BINAPINE (610304-81-9)

C₅₂H₄₈P₂; FW: 734.89;
white to light yellow powdr.

air sensitive

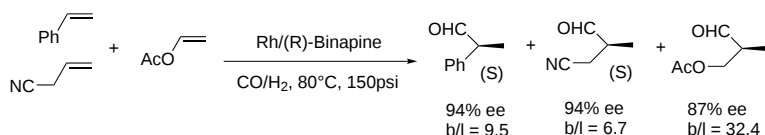
Note: Sold in collaboration with Chiral
Quest for research purposes only. US
Patent No. 7105702, 7153809, 7169953.



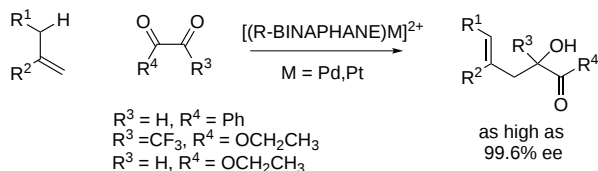
50mg
250mg

Technical Notes:

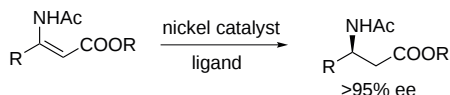
1. Rhodium complex used in asymmetric hydroformylation reactions.
2. Ligand-palladium complex used in enantioselective carbonyl-ene reactions.
3. Nickel-catalyzed asymmetric transfer hydrogenation of olefins for the synthesis of α - and β - amino acids.
4. Nickel-catalyzed asymmetric transfer hydrogenation of hydrazones and other ketimines.
5. Nickel/ligand catalyst used in the enantioselective reductive amination of ketones with both arylamines and benzhydrazide,
6. Rh-Binapine and Pd-Binapine complexes form excellent catalysts for asymmetric (transfer) hydrogenation of aryl substituted olefins to form β -amino acids.



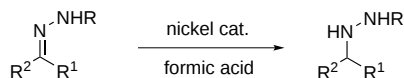
Tech. Note (1)
Ref. (1)



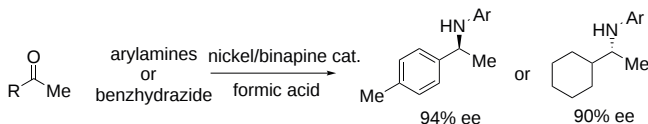
Tech. Note (2)
Ref. (2)



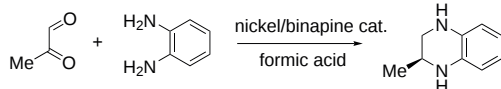
Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



References:

1. *Organometallics.*, **2006**, 25, 5003.
2. *Adv. Synth. Catal.*, **2010**, 352, 1356.
3. *Angew. Chem. Int. Ed.*, **2014**, 53, 12210.
4. *Angew. Chem. Int. Ed.*, **2015**, 54, 5112.
5. *Angew. Chem. Int. Ed.*, **2016**, 55, 12083.

PHOSPHORUS - Ligands and Compounds

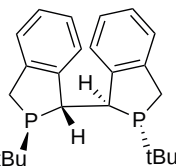
15-1060

(1*R*,1'*R*,2*S*,2'*S*)-(+)-2,2'-Di-*t*-butyl-2,3,2',3'-tetrahydro-1,1'-bi-1*H*-isophosphindole, min. 98% (*R,R,S,S*)-DUANPHOS (528814-26-8)

C₂₄H₃₂P₂; FW: 382.46; white xtl.

air sensitive

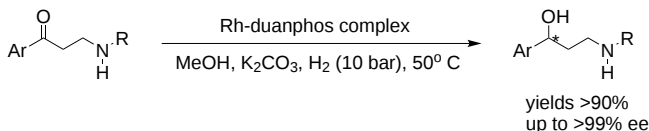
Note: Sold in collaboration with the Chiral Quest for research purposes only. Patent pending, PCT/US02/35788. Chiral Quest Catalyst and Ligand Toolbox Kit component.



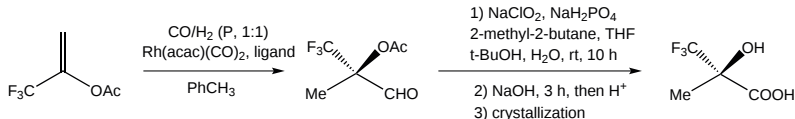
100mg
500mg

Technical Notes:

- As a highly electron-donating and conformationally rigid ligand, the rhodium complex of DuanPhos has exhibited remarkably high enantioselectivities and reactivities for the hydrogenation of a variety of functionalized olefins.
- Rhodium/DUANPHOS catalyst used in the synthesis of 2-trifluoromethyl lactic acid by asymmetric hydroformylation.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

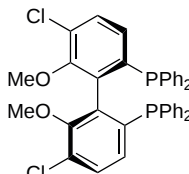
- Angew. Chem. Int. Ed., **2005**, 44, 1687.
- J. Org. Chem., **2013**, 78, 3429.

15-1055

(*R*)-(+)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (*R*)-Cl-MeO-BIPHEP (185913-97-7)

C₃₈H₃₀Cl₂O₂P₂; FW: 651.50; yellow-white powd.; m.p. 178°

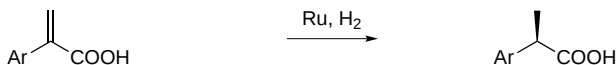
Note: Sold in collaboration with Lanxess for research purposes only. US Patents 5,710,339 and 5,801,261.



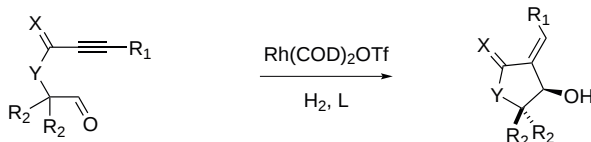
250mg
1g

Technical Notes:

- Ligand used in the ruthenium catalyzed, enantioselective hydrogenation of alkenes, carbonyls, and imines.
- Ligand used in the rhodium-catalyzed cyclization of acetylenic aldehydes.
- Ligand used in the iridium-catalyzed hydrogenative coupling of alkynes to aromatic and aliphatic N-arylsulfonyl aldimines.
- Asymmetric Cu-catalyzed propargylic substitution with amines,^{4a} and enamines.^{4b}
- Catalytic desymmetrizing intramolecular Heck reaction.
- Assembly of 1,3-polyols.
- Pd-catalyzed diastereo/enantioselective allylic alkylations of ketone enolates.
- Enantioselective vinylogous Reformatsky-type addition.
- Cu-catalyzed chemoselective preparation of 2-(pinacolato)boron- substituted allylcopper complexes and their *in situ* site-, diastereo-, and enantioselective additions to ketones.



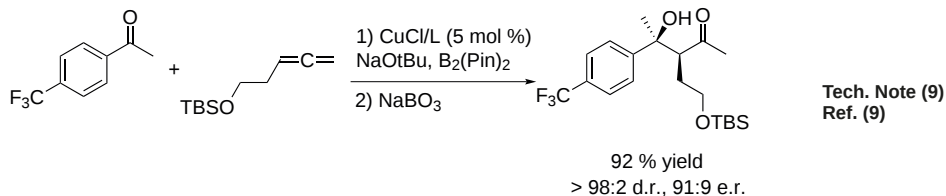
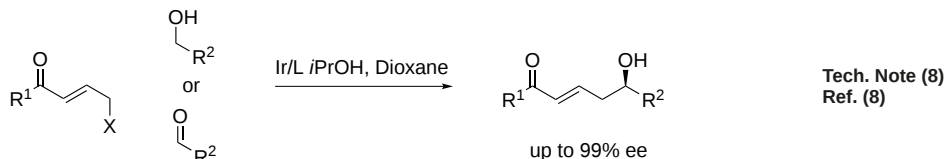
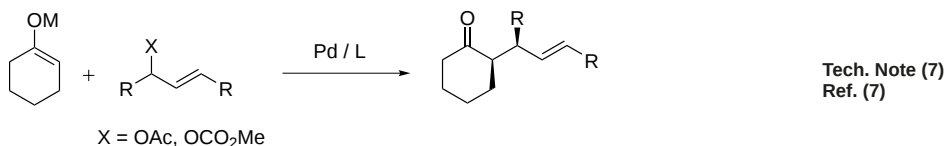
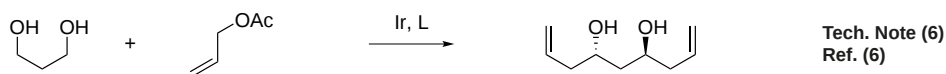
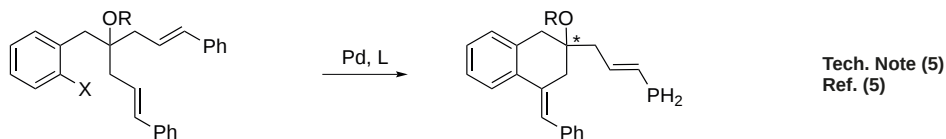
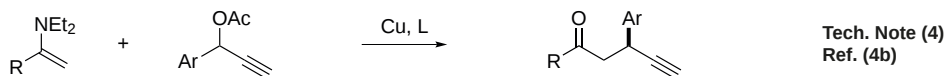
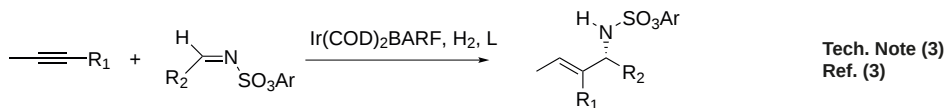
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

15-1055 (continued) (R)-(+)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (R)-Cl-MeO-BIPHEP (185913-97-7)



References:

1. Patents (Bayer) EP 0749973, DE 10027154.
2. *J. Am. Chem. Soc.*, **2006**, 128, 10674.
3. *J. Am. Chem. Soc.*, **2007**, 129, 12644.
4. (a) *Angew. Chem. Int. Ed.*, **2008**, 47, 3781. (b) *Org. Lett.*, **2009**, 11, 4612.
5. *Angew. Chem. Int. Ed.*, **2005**, 44, 149.
6. *Angew. Chem. Int. Ed.*, **2009**, 48, 5018.
7. *Adv. Synth. Catal.*, **2008**, 350, 303.
8. *Angew. Chem. Int. Ed.*, **2011**, 50, 3493.
9. *Angew. Chem. Int. Ed.*, **2013**, 52, 5046.

PHOSPHORUS - Ligands and Compounds

15-1056	(S)-(-)-5,5'-Dichloro-6,6'-dimethoxy-2,2'-bis(diphenylphosphino)-1,1'-biphenyl, min. 95% (S)-Cl-MeO-BIPHEP (185913-98-8) C ₃₈ H ₃₀ Cl ₂ O ₂ P ₂ ; FW: 651.50; yellow-white powd.; m.p. 178° Note: Sold in collaboration with Lanxess for research purposes only. US Patents 5,710,339 and 5,801,261.	250mg 1g
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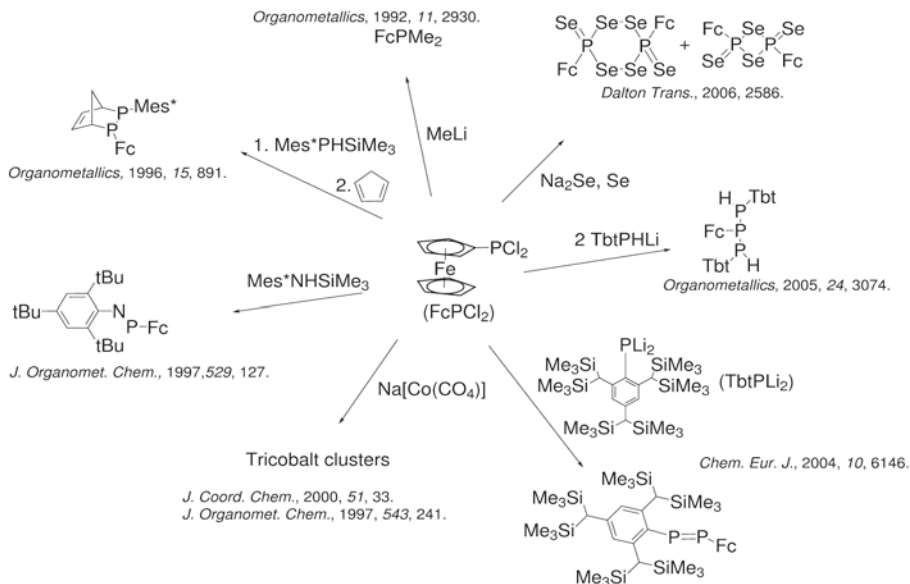
Technical Note:

1. See 15-1055 (page 156)

26-0985	Dichlorophosphinoferrocene, 98% (1291-31-2)		1g
HAZ	C ₁₀ H ₉ Cl ₂ FeP; FW: 286.90; red-brown viscous liq. (solid when cold) <i>moisture sensitive</i>	5g	

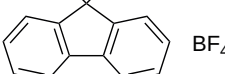
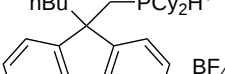
Technical Note:

1. Ferrocene organophosphorus building block.



References:

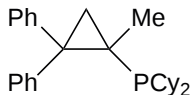
1. See above.

15-1072	Dicyclohexyl(9-benzylfluoren-9-yl) phosphonium tetrafluoroborate, min. 97% [cataCXium® FbN] (937378-18-2) $C_{32}H_{38}BF_4P$; FW: 540.42; white powdr. <i>air sensitive</i> Note: Sold in collaboration with Solvias for research purposes only. Patent Application Pending. Solvias cataCXium® Ligand Kit component.	 $Ph-CH_2-$ PCy_2H^+ BF_4^-	500mg 2g
15-1074	Dicyclohexyl(9-butylfluoren-9-yl) phosphonium tetrafluoroborate, min. 95% [cataCXium® FBu] (1007311-98-9) $C_{29}H_{40}BF_4P$; FW: 506.41; white powdr. Note: Sold in collaboration with Solvias for research purposes only. Patent Application Pending. Solvias cataCXium® Ligand Kit component.	 $nBu-$ PCy_2H^+ BF_4^-	500mg 2g

PHOSPHORUS - Ligands and Compounds

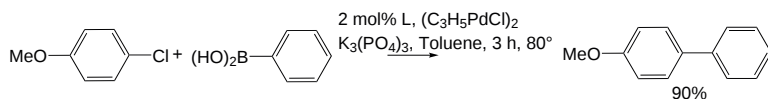
15-1050	Dicyclohexylchlorophosphine, min. 98% (16523-54-9)	1g
amp	(C ₆ H ₁₁) ₂ PCl; FW: 232.74; colorless to pale yellow, cloudy liq.;	5g
HAZ	b.p. 96-99°/0.1 mm; d. 1.054	
	<i>air sensitive, moisture sensitive</i>	

15-1007	Dicyclohexyl(2,2-diphenyl-1-methyl-cyclopropyl)phosphine Cy-cBRIDP (1023330-38-2)	250mg
	C ₂₈ H ₃₇ P; FW: 404.57;	1g
	white to pale yellow solid	5g
	<i>air sensitive, (store cold)</i>	
	Note: Manufactured under license of Takasago patent US7129367B2.	

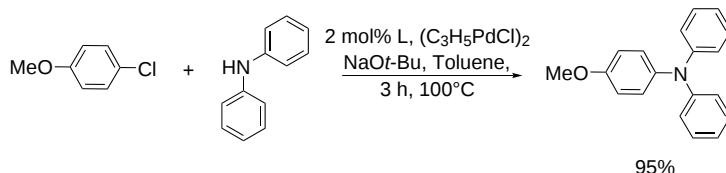


Technical Notes:

- Ligand effective for many classes of palladium-catalyzed coupling of aryl halides, including the Miyaura-Suzuki, Buchwald-Hartwig, Sonogashira, Heck, aryl etherification, and carbonylation reactions.
- Ligand used in the palladium catalyzed Suzuki-Miyaura coupling of aryl boronic acids.
- Ligand employed in the palladium-catalyzed Buchwald-Hartwig aryl amination reaction.



Tech. Note (1,2)
Ref. (1,2)

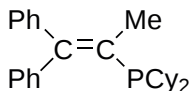


Tech. Note (1,3)
Ref. (1)

References:

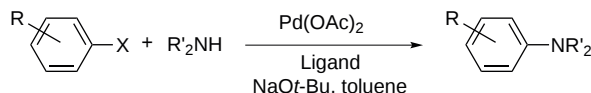
- US Patent 7129367.
- Synlett., **2008**, 12, 1809.

15-1062	Dicyclohexyl(2,2-diphenyl-1-methylvinyl) phosphine Cy-vBRIDP (384842-24-4)	250mg
	C ₂₅ H ₃₅ P; FW: 366.52;	1g
	white to pale yellow solid	5g
	<i>air sensitive, (store cold)</i>	
	Note: Manufactured under license of Takasago patent US6455720.	

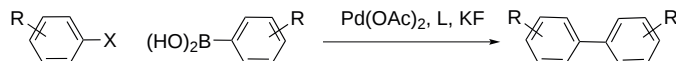


Technical Notes:

- Ligand used in the Pd-catalyzed amination of aryl halides.
- Ligand used for Suzuki-Miyaura coupling.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

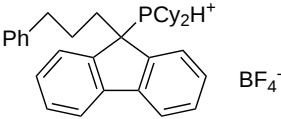
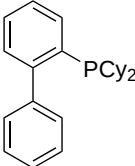
References:

- Adv. Synth. Catal., **2007**, 349, 2089.
- Synlett., **2007**, 20, 3206.

15-1100	Dicyclohexylphenylphosphine, min. 95% (6476-37-5)	1g
	(C ₆ H ₁₁) ₂ (C ₆ H ₅)P; FW: 274.38; white solid	5g
	<i>air sensitive</i>	

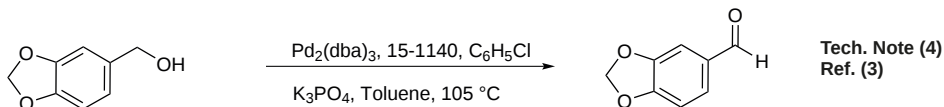
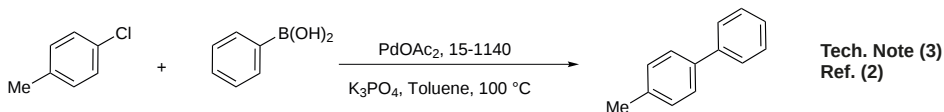
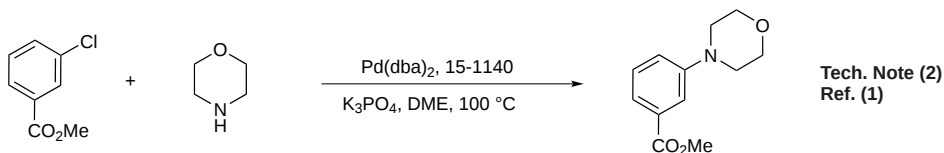


PHOSPHORUS - Ligands and Compounds

15-1076	Dicyclohexyl[9-(3-phenylpropyl)fluoren-9-yl]phosphonium tetrafluoroborate, min. 95% [cataCXium® FPrPh] (1007311-95-6) $C_{34}H_{42}BF_4P$; FW: 568.48; white powdr. <i>air sensitive</i> Note: Sold in collaboration with Solvias for research purposes only. Patent Application Pending. Solvias cataCXium® Ligand Kit component.		500mg 2g
15-1120 amp HAZ 	Dicyclohexylphosphine, 98% (829-84-5) $(C_6H_{11})_2PH$; FW: 198.29; light yellow liq.; b.p. 129°/8 mm; d. 0.98 <i>pyrophoric</i>		2g 10g 50g
15-1122 HAZ	Dicyclohexylphosphine, 98% (10 wt% in hexanes) (829-84-5) $(C_6H_{11})_2PH$; FW: 198.29; colorless liq. <i>air sensitive</i>		20g 100g
15-1140	2-(Dicyclohexylphosphino))-1,1'-biphenyl, 98% CyJohnPhos (247940-06-3) $C_{24}H_{31}P$; FW: 350.49; white xtl.; m.p. 103° Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 2 component.. Patents: US 6,395,916, US 6,307,087.		1g 5g 25g 100g

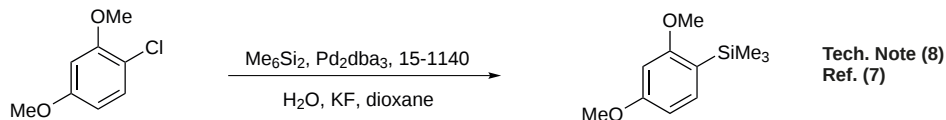
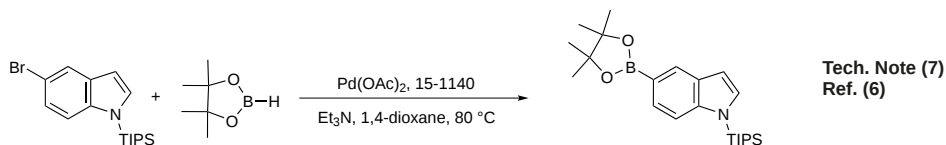
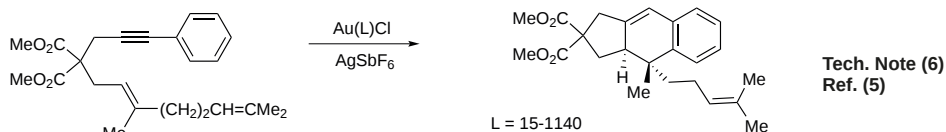
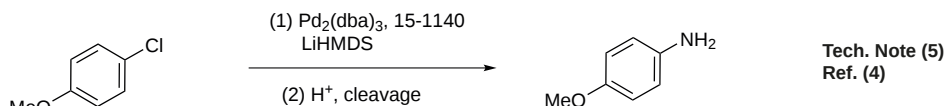
Technical Notes:

1. See 15-1045.
2. Ligand used in the palladium-catalyzed synthesis of aromatic amines from aryl chlorides, bromides and triflates.
3. Ligand employed in Suzuki coupling reactions involving aryl chlorides, bromides and triflates.
4. Useful ligand for the Pd-catalyzed oxidation of alcohols in the presence of chlorobenzenes.
5. Useful ligand for the Pd-catalyzed amination with ammonia equivalents
6. Ligand for the gold(I)-catalyzed intramolecular [4+2] cycloadditions involving 1,3-enynes and arylalkynes with alkenes
7. Ligand used in the palladium-catalyzed borylation of aryl bromides.
8. Ligand used in the palladium-catalyzed silylation of aryl chlorides.



PHOSPHORUS - Ligands and Compounds

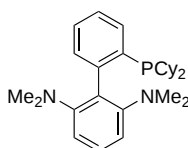
15-1140 2-(Dicyclohexylphosphino))-1,1'-biphenyl, 98% CyJohnPhos (247940-06-3)
(continued)



References:

1. *J. Org. Chem.*, **2000**, 65, 1158.
2. *J. Am. Chem. Soc.*, **1999**, 121, 9550.
3. *Org. Lett.*, **2003**, 5, 2485.
4. *Org. Lett.*, **2001**, 3, 3417.
5. *J. Am. Chem. Soc.*, **2005**, 127, 6178.
6. *Helv. Chim. Acta.*, **2006**, 89, 936.
7. *Org. Lett.*, **2007**, 9, 3785.
8. *Chem. Sci.*, **2011**, 2, 27.

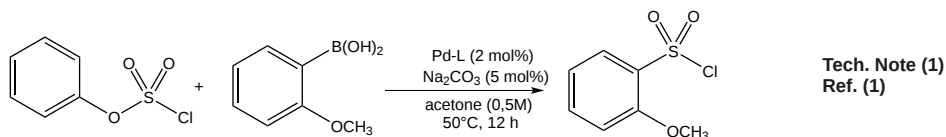
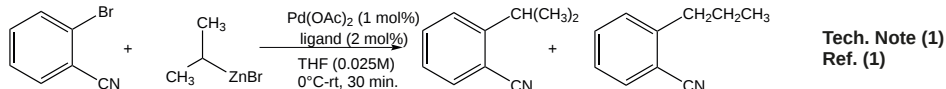
15-1147 2-Dicyclohexylphosphino-2',6'-bis(dimethylamino)-1,1'-biphenyl, min. 98% CPhos (1160556-64-8)
C₂₈H₄₁N₂P; FW: 436.61; yellow-orange xtl.; m.p. 111-113°
Note: Patents: US 6,395,916, US 6,307,087



250mg
1g
5g

Technical Note:

1. Preparation of aryl sulfonamides via palladium-catalyzed chlorosulfonylation of arylboronic acids.



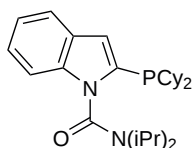
References:

1. *J. Am. Chem. Soc.*, **2013**, 135, 10638.
2. *J. Am. Chem. Soc.*, **2009**, 131, 7532.

PHOSPHORUS - Ligands and Compounds

15-1086

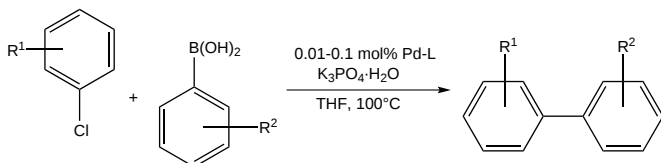
2-(Dicyclohexylphosphino)-N,N-bis(1-methylethyl)-1H-indole-1-carboxamide, min. 98% Amidole-Phos (1067175-36-3)
 $C_{27}H_{41}N_2OP$; FW: 440.60; white to off-white powdr.; m.p. 192.1-193.8°



100mg
500mg

Technical Note:

1. Suzuki-Miyaura Coupling of Aryl Chlorides (low catalyst loading).



$R^1 = \text{Me, MeO, NH}_2, \text{CO}_2\text{Me, COMe, pyr}$; $R^2 = \text{Me, Np, Bu}$

up to 99% yield

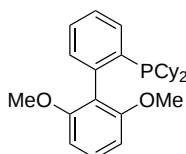
Tech. Note (1)
Ref. (1)

References:

1. *J. Org. Chem.* **2008**, 73, 7803.

15-1143

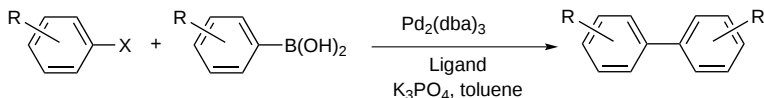
2-Dicyclohexylphosphino-2',6'-dimethoxy-1,1'-biphenyl, min. 98% SPhos (657408-07-6)
 $C_{26}H_{35}O_2P$; FW: 410.53; white xtl.; m.p. 164-166°
 Note: Buchwald Biaryl Phosphine Ligand Master Kit component. Buchwald Biaryl Phosphine Ligand Mini Kit 1 component.
 Patents: US 6,395,916, US 6,307,087.



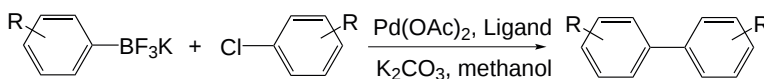
500mg
2g
10g
50g

Technical Notes:

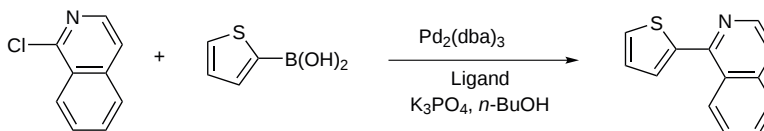
1. Ligand/palladium catalyst for general Suzuki-Miyaura cross-coupling reactions.
2. Ligand/palladium catalyst for the Suzuki-Miyaura coupling of aryltrifluoroborates with aryl chlorides.
3. Ligand/palladium catalyst for the Suzuki-Miyaura reaction of heteroaryl halides and heteroaryl boronic acids and esters.
4. Ligand/palladium catalyst for the Kumada-Corriu cross-coupling reaction.
5. Ligand/palladium catalyst for the borylation of aryl halides with pinacol borane.
6. Suzuki couplings involving amino acids. Synthesis of biaryl derivatives of 4-hydroxyphenyl glycine, tyrosine and tryptophan.
7. Synthesis of substituted adamantylzinc reagents using Mg-insertion in the presence of zinc chloride.
8. Highly efficient catalyst for the palladium-catalyzed Suzuki-Miyura reaction of heteroaryl halides and heteroaryl boronic acids and esters.



Tech. Note (1)
Ref. (1)



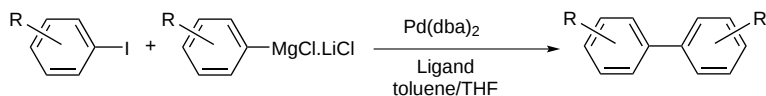
Tech. Note (2)
Ref. (2)



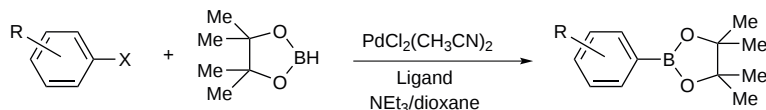
Tech. Note (3)
Ref. (3)

PHOSPHORUS - Ligands and Compounds

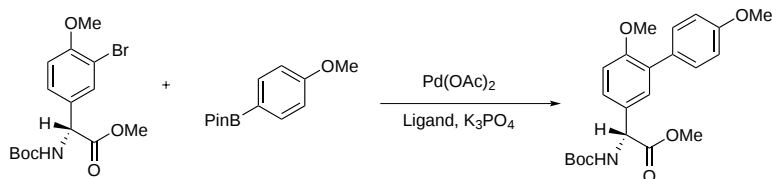
15-1143 2-Dicyclohexylphosphino-2',6'-dimethoxy-1,1'-biphenyl, min. 98% SPhos (657408-07-6)
(continued)



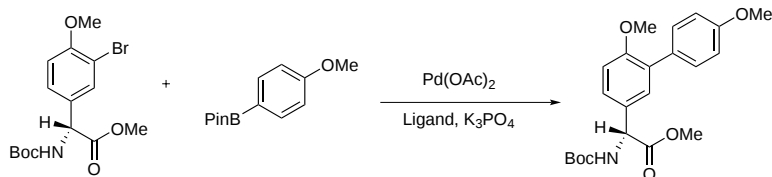
Tech. Note (4)
Ref. (4)



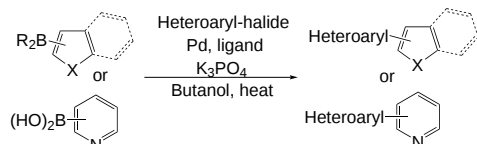
Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (5)



Tech. Note (7)
Ref. (6)

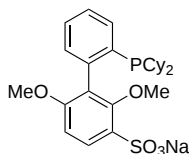


Tech. Note (8)
Ref. (3)

References:

1. *Angew. Chem., Int. Ed.*, **2004**, 43, 1871.
2. *Org. Lett.*, **2004**, 6, 2649.
3. *J. Am. Chem. Soc.*, **2007**, 129, 3358.
4. *J. Am. Chem. Soc.*, **2008**, 129, 3844.
5. *J. Org. Chem.*, **2008**, 73, 5589.
6. *Org. Lett.*, **2014**, 16, 2418.

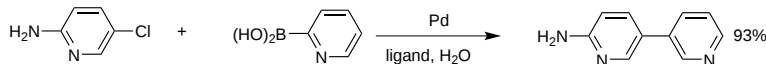
15-1142 2'-Dicyclohexylphosphino-2,6-dimethoxy-3-sulfonato-1,1'-biphenyl hydrate sodium salt (water soluble SPhos), min. 98% (1049726-96-6)
C₂₆H₃₄NaO₅PS·XH₂O; FW: 512.58; light yellow solid
Note: Water soluble version of 15-1143 S-Phos. Buchwald Biaryl Ligand Master Kit component. Patents: US 6,395,916 and US 6,307,087.



500mg
2g
10g

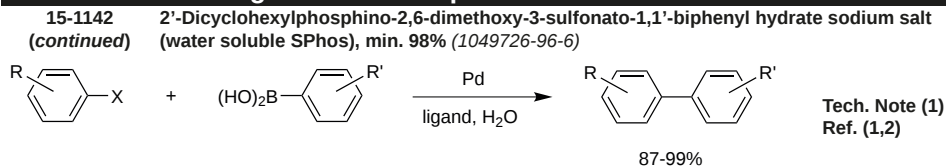
Technical Note:

1. First general ligand for the Pd-catalyzed Suzuki-Miyaura coupling reaction of aryl chlorides and for the coupling of challenging substrate combinations in water.



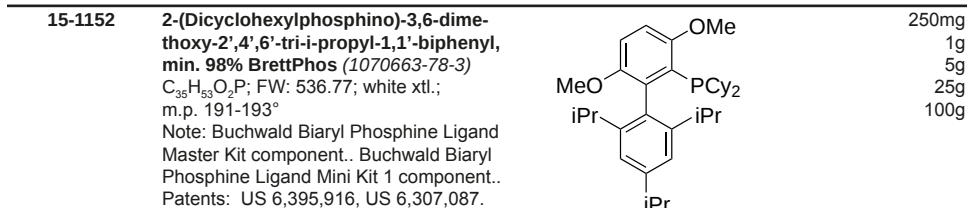
Tech. Note (1)
Ref. (1,2)

PHOSPHORUS - Ligands and Compounds



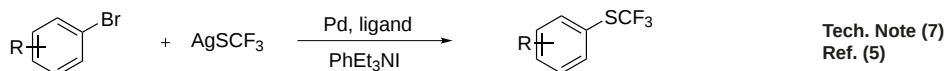
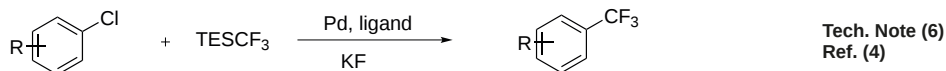
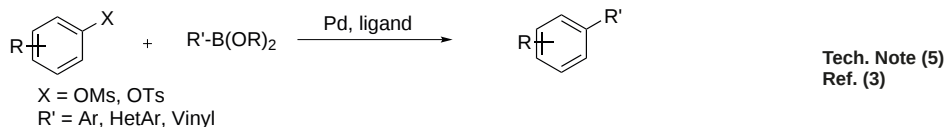
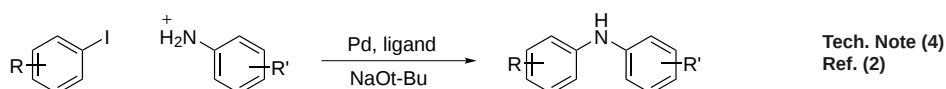
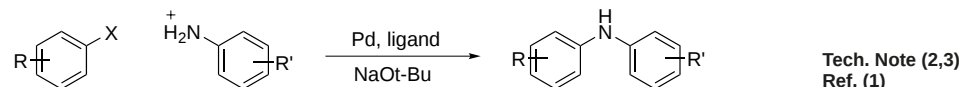
References:

1. *Angew. Chem. Int. Ed.*, **2005**, *44*, 6173.
2. *Acc. Chem. Res.* **2008**, *41*, 1461.



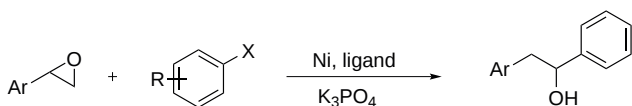
Technical Notes:

1. Versatile Ligand for the Pd-catalyzed coupling of primary arylamines and alkylamines. (a) See also 46-0367, 46-0267. (b) See references 7,8.
2. Ligand for palladium-catalyzed cross-coupling reactions using aryl mesylates with electron-deficient anilines.
3. Ligand for palladium-catalyzed cross-coupling of primary arylamines at low catalyst loading.
4. Ligand for palladium-catalyzed cross-coupling of aryl iodides and primary amines.
5. Ligand for the Suzuki-Miyaura coupling of tosylates and mesylates.
6. Ligand for the palladium-catalyzed trifluoromethylation of aryl chlorides.
7. Ligand for the palladium-catalyzed formation of aryl-SCF₃ compounds from aryl bromides.
8. Ligand for the nickel-catalyzed cross-coupling of styrenyl epoxides with boronic acids.
9. Ligand for the palladium-catalyzed intramolecular CH difluoroalkylation.

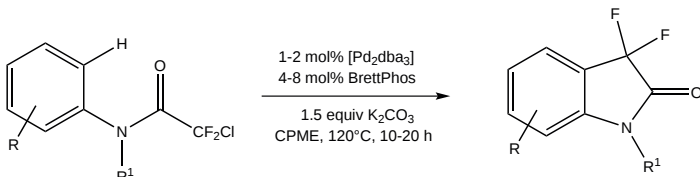


PHOSPHORUS - Ligands and Compounds

15-1152 2-(Dicyclohexylphosphino)-3,6-dimethoxy-2',4',6'-tri-*i*-propyl-1,1'-biphenyl, min. 98%
(continued) BrettPhos (1070663-78-3)



Tech. Note (8)
Ref. (6)

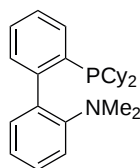


Tech. Note (9)
Ref. (9)

References:

1. *J. Am. Chem. Soc.*, **2008**, *130*, 13552.
2. *J. Am. Chem. Soc.*, **2009**, *131*, 5766.
3. *Org. Lett.*, **2009**, *11*, 3954.
4. *Science*, **2010**, *328*, 1679
5. *Angew. Chem, Int. Edit.*, **2011**, *50*, 7312.
6. *Angew. Chem. Int. Edit.*, **2011**, *50*, 6056.
7. *Chem. Sci.*, **2011**, *2*, 27.
8. *Chem. Sci.*, **2011**, *2*, 57.
9. *Angew. Chem, Int. Edit.*, **2014**, *53*, 1.

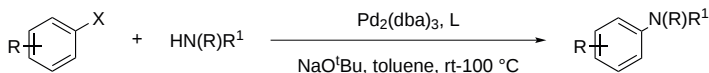
15-1145 2-(Dicyclohexylphosphino)-2'-(*N,N*-dimethylamino)-1,1'-biphenyl, 98% DavePhos (213697-53-1)
C₂₆H₃₆NP; FW: 393.55; white xtl.; m.p. 115-119°
Note: Buchwald Biaryl Phosphine Ligand Master Kit component. Buchwald Biaryl Phosphine Ligand Mini Kit 2 component. Patents: US 6,395,916, US 6,307,087.



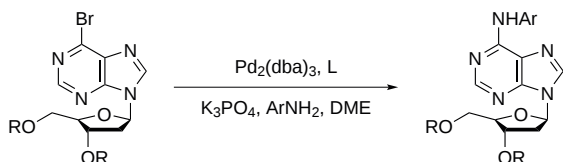
500mg
2g
10g
50g

Technical Notes:

1. Ligand used in the Pd-catalyzed Suzuki coupling and amination of unactivated aryl chlorides. The reactions generally occur at room temperature and give high yields of product.
2. Ligand used in Pd-catalyzed C-N bond formation. A general synthesis of N6-aryl-2'-deoxyadenosine analogues.
3. Ligand used in Pd-catalyzed N-arylation of indoles.
4. Ligand used in Pd-catalyzed synthesis of aryl-tert-butyl ethers.
5. Effective ligand in the Pd-catalyzed arylation of ester enolates.
6. Ligand employed in arylation of ketone enolates using ortho-halo nitrobenzenes.
7. Ligand employed in the amination of aryl nonaflates using Pd catalysts.
8. Ligand used for cascade alkenyl amination/Heck reaction for the synthesis of indoles
9. Ligand used in Pd-catalyzed Kumada-Corriu cross coupling at low temperatures
10. Ligand used in Rh-catalyzed intramolecular hydroamination of unactivated terminal and internal alkenes with primary and secondary amines.
11. Ligand used in Au-catalyzed cycloisomerization of allenes.



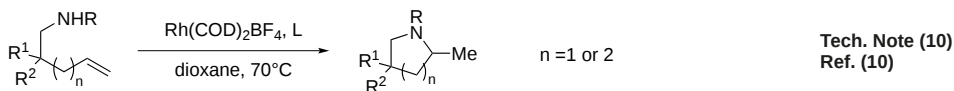
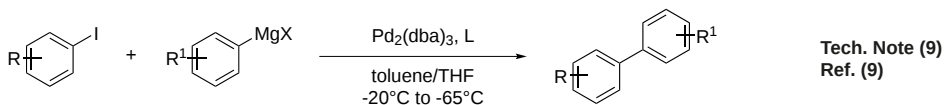
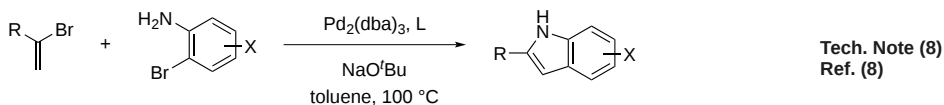
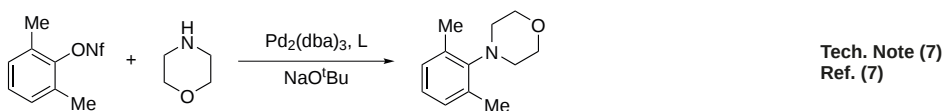
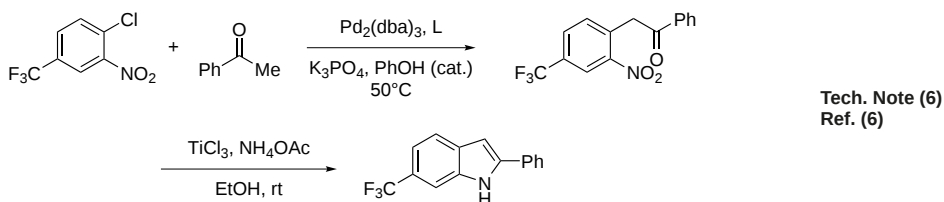
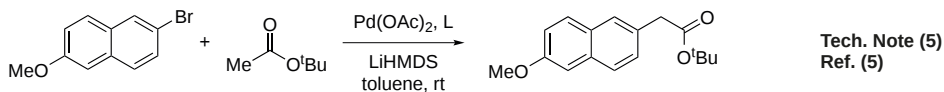
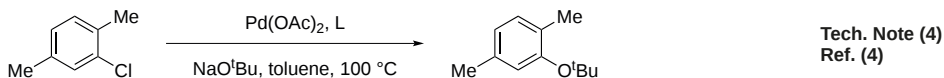
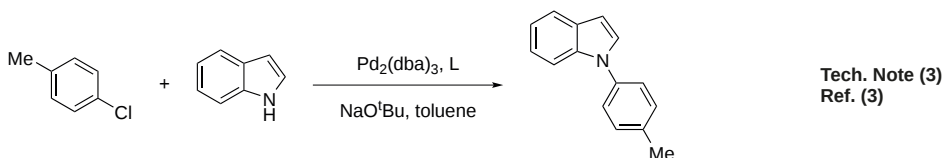
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

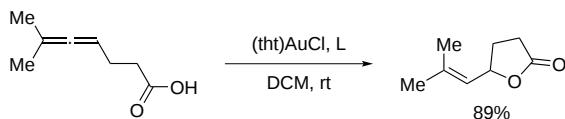
PHOSPHORUS - Ligands and Compounds

15-1145 2-(Dicyclohexylphosphino)-2'-(N,N-dimethylamino))-1,1'-biphenyl, 98% DavePhos
(continued) (213697-53-1)



PHOSPHORUS - Ligands and Compounds

15-1145 2-(Dicyclohexylphosphino)-2'-(N,N-dimethylamino))-1,1'-biphenyl, 98% DavePhos
(continued) (213697-53-1)

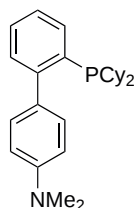


Tech. Note (11)
Ref. (11)

References:

1. *J. Am. Chem. Soc.*, **1998**, *120*, 9722
2. *J. Am. Chem. Soc.*, **1999**, *121*, 6090.
3. *Org. Lett.*, **2000**, *2*, 1403.
4. *J. Org. Chem.*, **2001**, *66*, 2498.
5. *J. Am. Chem. Soc.*, **2001**, *123*, 7996.
6. *J. Am. Chem. Soc.*, **2002**, *124*, 15168.
7. *J. Org. Chem.*, **2003**, *68*, 9563.
8. *Chem. Eur. J.*, **2005**, *11*, 2276
9. *J. Am. Chem. Soc.*, **2007**, *129*, 3844.
10. *J. Am. Chem. Soc.*, **2008**, *130*, 1570.
11. *Adv. Synth. Catal.*, **2009**, *351*, 576.
12. *Chem. Sci.*, **2011**, *2*, 27.

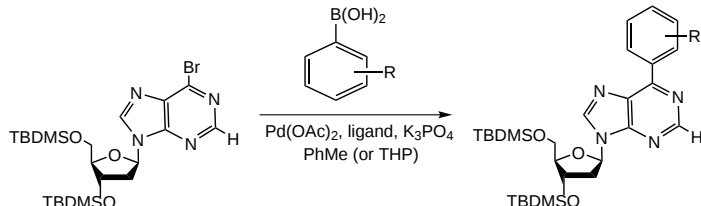
15-1154 2-Dicyclohexylphosphino-4'-(N,N-dimethylamino)-1,1'-biphenyl, 98% (1185899-00-6)
NEW C₂₆H₃₆NP; FW: 393.55; white xtl.
Note: Patents: US 6,395,916, US 6,307,087.



250mg
1g
5g

Technical Note:

1. Ligand used in the palladium-catalyzed C-C bond formation in a substituted deoxyguanosine.

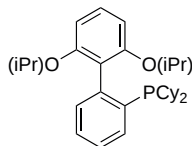


Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.*, **2009**, *131*, 12240.

15-1146 2-Dicyclohexylphosphino-2',6'-di-i-propoxy- 1,1'-biphenyl, min. 98% RuPhos (787618-22-8)
C₃₀H₄₃O₂P; FW: 466.64; white powdr.; m.p. 123-124°
Note: Buchwald Biaryl Phosphine Ligand Master Kit component. Buchwald Biaryl Phosphine Ligand Mini Kit 1 component. Patents: US 6,395,916, US 6,307,087.



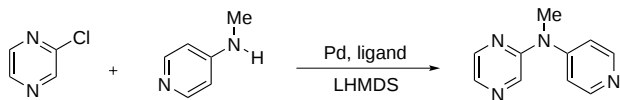
1g
5g
25g
100g

Technical Notes:

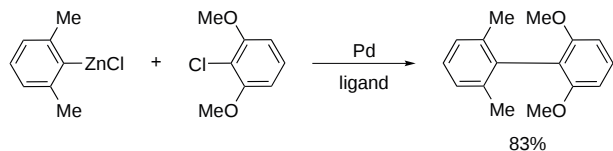
1. Versatile Ligand for the Pd-catalyzed coupling of secondary arylamines and alkylamines.
(a) See also 46-0266, 46-0366. (b) See reference 7, 8.
2. Ligand used for the Pd-catalyzed Negishi cross-coupling reaction of (hetero)arylchlorides.
3. Ligand used for the Pd-catalyzed synthesis of N-aryl benzimidazoles
4. Ligand used for the Pd-catalyzed synthesis of heteroacenes.
5. Versatile ligand used for the Pd-catalyzed C-N coupling reaction of secondary aryl- and alkyl-amines at low temperature with the Pd precatalyst.
6. Ligand used for the Pd-catalyzed Suzuki-Miyaura coupling of aryl chloride and NHC-boranes.
7. Ligand for the palladium-catalyzed trifluoromethylation of hindered aryl chlorides.
8. Ligand used for the palladium-catalyzed coupling of alkyl boronates.

PHOSPHORUS - Ligands and Compounds

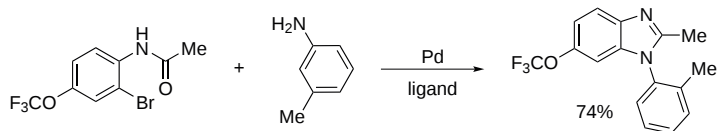
15-1146 2-Dicyclohexylphosphino-2',6'-di-i-propoxy- 1,1'-biphenyl, min. 98% RuPhos
(continued) (787618-22-8)



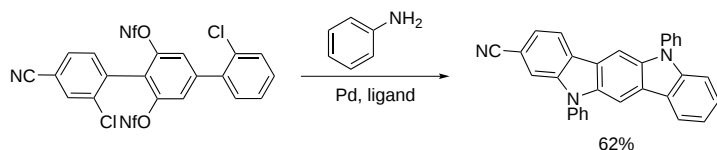
Tech. Note (1)
Ref. (6,7)



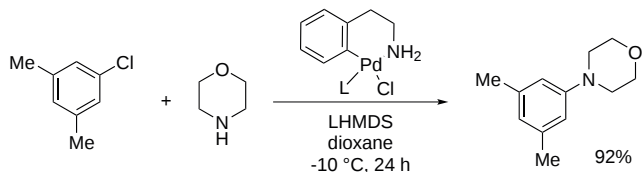
Tech. Note (2)
Ref. (1)



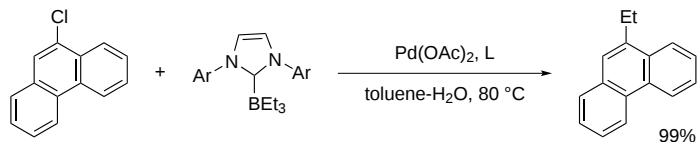
Tech. Note (3)
Ref. (2)



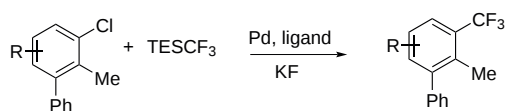
Tech. Note (4)
Ref. (3)



Tech. Note (5)
Ref. (4)



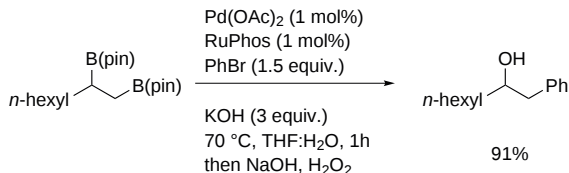
Tech. Note (6)
Ref. (5)



Tech. Note (7)
Ref. (6)

PHOSPHORUS - Ligands and Compounds

15-1146 2-Dicyclohexylphosphino-2',6'-di-i-propoxy- 1,1'-biphenyl, min. 98% RuPhos
(continued) (787618-22-8)

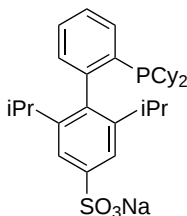


Tech. Note (8)
Ref. (9)

References:

1. *J. Am. Chem. Soc.*, **2004**, 126, 13028.
2. *Angew. Chem. Int. Ed.*, **2007**, 46, 7509.
3. *J. Org. Chem.*, **2007**, 72, 5119.
4. *J. Am. Chem. Soc.*, **2008**, 130, 6686.
5. *Org. Lett.*, **2009**, 11, 4914.
6. *Science*, **2010**, 328, 1679.
7. *Chem. Sci.*, **2011**, 2, 27.
8. *Chem. Sci.*, **2011**, 2, 57.
9. *Nature*, **2014**, 505, 386.

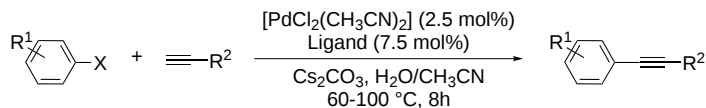
15-1135 2'-Dicyclohexylphosphino-2,6-di-i-propyl-4-sulfonato-1,1'-biphenyl hydrate sodium salt (XPhos-SO₃Na) (870245-84-4)
C₃₀H₄₂NaO₃PS·XH₂O; FW: 536.68; beige solid
Note: Water soluble phosphine. Buchwald Biaryl Phosphine Ligand Master Kit component. Patents: US 6,395,916, US 6,307,087.



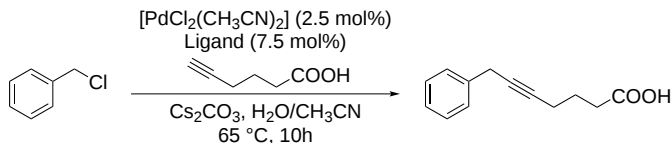
100mg
500mg
2g

Technical Notes:

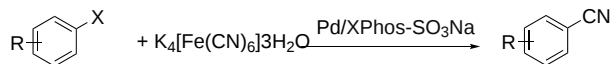
1. Water soluble catalyst for Sonogashira coupling reactions
2. Water soluble catalyst for coupling of benzyl chloride and terminal alkynes.
3. Water soluble ligand for cyanation of aryl chlorides and aryl sulfonates with potassium ferrocyanide.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



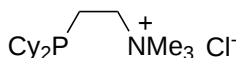
Tech. Note (3)
Ref. (3)

References:

1. *Angew. Chem. Int. Ed.*, **2005**, 44, 6173.
2. *Synlett.*, **2006**, 18, 2941.
3. *Catal. Lett.*, **2010**, 139, 56.

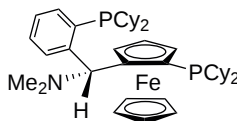
PHOSPHORUS - Ligands and Compounds

15-1144 [2-(Dicyclohexylphosphino)ethyl]trimethylammonium chloride, min. 95% (181864-78-8)
(C₆H₁₁)₂PCH₂CH₂N(CH₃)₃⁺Cl⁻; FW: 319.89; white powdr.
hygroscopic



1g
5g

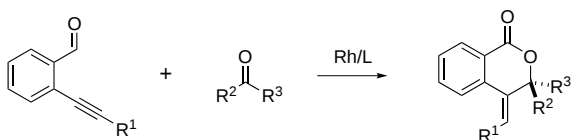
26-0956 (R)-(+)-[(R)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino)(2-dicyclohexylphosphinophenyl)methane, min. 97% (1156547-61-3)
C₄₃H₆₃FeNP₂; FW: 711.76; orange powdr.
(store cold)
Note: Sold in collaboration with Solvias for research purposes only.



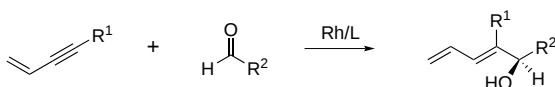
100mg
500mg
2g
10g

Technical Notes:

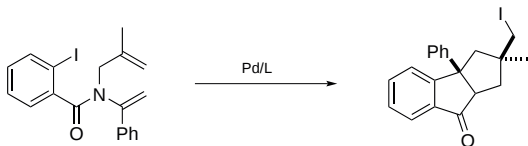
1. Ligand for Rh and Ru-catalyzed hydrogenation of alkenes and ketones.
2. Rh-catalyzed intermolecular [4+2].
3. Enantioselective reductive coupling of 1,3-enynes to heterocyclic aromatic aldehydes and ketones.
4. Pd-catalyzed enantioselective carbohalogenation.



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

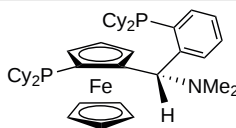


Tech. Note (4)
Ref. (4)

References:

1. (a) *Adv. Synth. Catal.*, **2003**, 345, 160, (b) *Org. Lett.*, **2006**, 8, 2413
2. *Angew. Chem.*, **2008**, 120, 5904
3. *J. Am. Chem. Soc.*, **2006**, 128, 16448
4. *J. Am. Chem. Soc.*, **2011**, 133, 14916

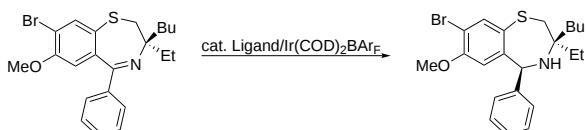
26-0955 (S)-(-)-[(S)-2-Dicyclohexylphosphinoferrocenyl](N,N-dimethylamino)(2-dicyclohexylphosphinophenyl)methane, min. 97% (914089-00-2)
C₄₃H₆₃FeNP₂; FW: 711.76; orange powdr.
(store cold)
Note: Sold in collaboration with Solvias for research purposes only.



100mg
500mg
2g
10g

Technical Note:

1. Ligand for the iridium-catalyzed asymmetric cis hydrogenation bromobenzodiazepine.



Tech. Note (2)
Ref. (2)

References:

1. *J. Org. Chem.*, **2013**, 78, 12726.

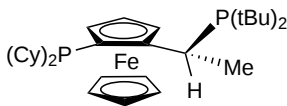
PHOSPHORUS - Ligands and Compounds

26-0975

(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethyl-di-*t*-butylphosphine, min. 97% (158923-11-6)

C₃₂H₅₂FeP₂, FW: 554.56; orange powdr.

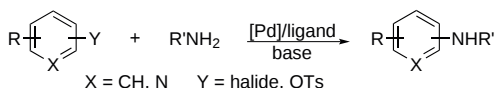
Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.



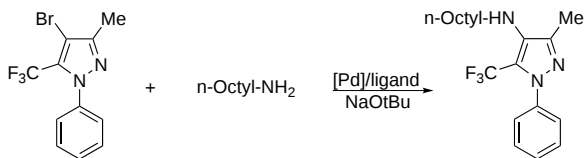
100mg
500mg
2g
10g

Technical Notes:

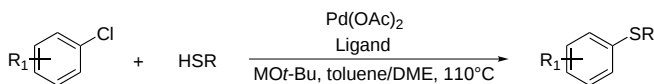
1. Ligand for Palladium-catalyzed C-N cross-coupling.
2. Ligand for Palladium-catalyzed C-S cross-coupling.
3. Ligand for Palladium-catalyzed Kumada couplings of aryl and vinyl tosylates.
4. Ligand for Rhodium-catalyzed hydroacylation of cyclopropenes, an enantioselective desymmetrization method.
5. Ligand for Palladium-catalyzed C-O cross-coupling.
6. Ligand for Rhodium-catalyzed coupling of imidazole derivatives with terminal allenes.
7. Ligand for Ruthenium-catalyzed C-C coupling of alkynes and alcohols to form branched products of carbonyl allylation.



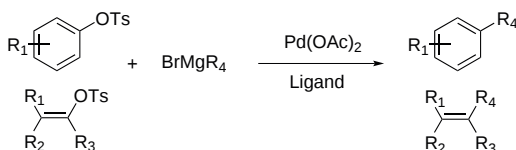
Tech. Note (1)
Ref. (1,2,3,4,5)



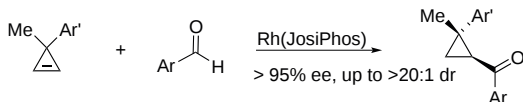
Tech. Note (1)
Ref. (6)



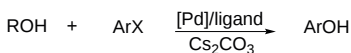
Tech. Note (2)
Ref. (7)



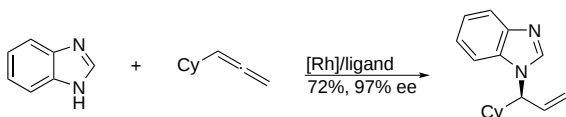
Tech. Note (3)
Ref. (8)



Tech. Note (4)
Ref. (9)



Tech. Note (5)
Ref. (10,11)



Tech. Note (6)
Ref. (12)

PHOSPHORUS - Ligands and Compounds

26-0975 (R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethyldi-*t*-butylphosphine, min. 97%
(continued) (158923-11-6)

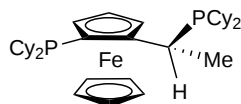


Tech. Note (7)
Ref. (13)

References:

1. *Angew. Chem. Int. Ed.*, **2005**, 44, 1371. (X=N; Y=Cl)
2. *J. Am. Chem. Soc.*, **2008**, 130, 13848. (X=CH,N; Y=OTs)
3. *J. Am. Chem. Soc.*, **2009**, 131, 11049. (X=CH,N; Y=I,Br,Cl,OTs; R'=H [ammonia])
4. *Tetrahedron Lett.*, **2014**, 55, 6743. (X=N; Y=Cl)
5. *Org. Lett.*, **2014**, 16, 4388. (X=CH; Y=Cl,Br; R'=ammonium salt)
6. *Org. Biomol. Chem.*, **2016**, 14, 2352.
7. *J. Am. Chem. Soc.*, **2006**, 128, 2180.
8. *J. Org. Chem.*, **2005**, 70, 9364.
9. *J. Am. Chem. Soc.*, **2010**, 132, 16354.
10. *Angew. Chem. Int. Ed.*, **2012**, 51, 9071.
11. *Tetrahedron Lett.*, **2015**, 56, 2329.
12. *Angew. Chem. Int. Ed.*, **2014**, 53, 2162.
13. *J. Am. Chem. Soc.*, **2015**, 137, 3161.

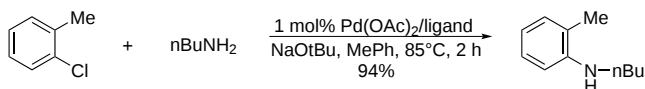
26-1000 (R)-(-)-1-[(S)-2-(Di-cyclohexylphosphino) ferrocenyl] ethyldicyclohexylphosphine, min. 97%
(167416-28-6)
C₃₆H₅₆FeP₂; FW: 606.64; orange powdr.
Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.



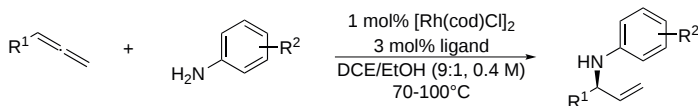
100mg
500mg
2g
10g

Technical Notes:

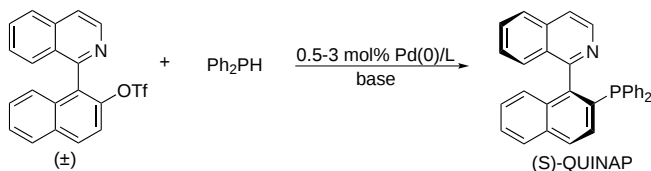
1. Ligand for Pd-catalyzed C-N cross-coupling.
2. Ligand for Rh-catalyzed C-N cross-coupling.
3. Ligand for Pd-catalyzed asymmetric synthesis of (S)-QUINAP via dynamic kinetic resolution.
4. Ligand for Ni-catalyzed monoarylation of ammonia.



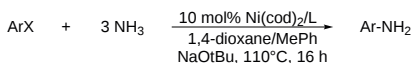
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2,4)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (5)

References:

1. *J. Am. Chem. Soc.*, **1998**, 120, 7369.
2. *Angew. Chem. Int. Ed.*, **2012**, 51, 10876.
3. *J. Am. Chem. Soc.*, **2013**, 135, 16829.
4. *Angew. Chem. Int. Ed.*, **2014**, 53, 2162.
5. *Angew. Chem. Int. Ed.*, **2015**, 54, 3773.

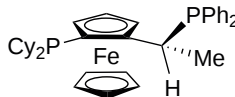
PHOSPHORUS - Ligands and Compounds

26-1001	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidicyclohexylphosphine, min. 97% (246231-77-6)	100mg 500mg
	C ₃₆ H ₅₆ FeP ₂ ; FW: 606.64; orange powdr.	2g
	Note: Sold in collaboration with Solvias for research purposes only.	10g

Technical Note:

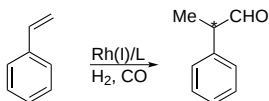
1. See 26-1000 (page 172)

26-1230	(R)-(-)-1-[(S)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidiphenylphosphine, min. 97% (158923-09-2)	100mg 500mg
	C ₃₆ H ₄₄ FeP ₂ ; FW: 594.59; orange powdr.	2g
	Note: Sold in collaboration with Solvias for research purposes only.	10g

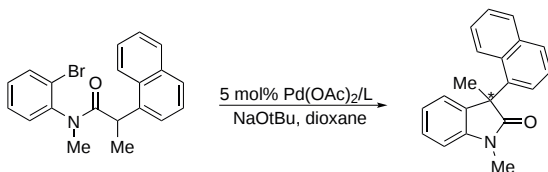


Technical Notes:

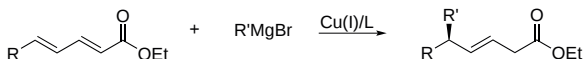
1. Ligand for the asymmetric hydroformylation reactions.
2. Ligand for asymmetric intramolecular amide arylation.
3. Ligand for enantioselective 1,6-conjugate addition of Grignard reagents to linear dienolates.
4. Ligand for enantioselective synthesis of vicinal dialkyl arrays
5. Ligand for asymmetric conjugate addition of Grignard reagents to chromones



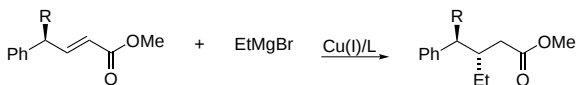
Tech. Note (2)
Ref. (1)



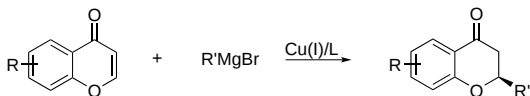
Tech. Note (3)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

References:

1. *J. Organomet. Chem.*, **2000**, 601, 138
2. *J. Org. Chem.*, **2001**, 66, 3402
3. *Angew. Chem. Int. Ed.*, **2008**, 47, 398.
4. *J. Org. Chem.*, **2008**, 73, 6994.
5. *Chem. Commun.*, **2013**, 49, 5933.

26-1101	(S)-(+)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethylidiphenylphosphine, min. 97% (162291-01-2)	100mg 500mg
	C ₃₆ H ₄₄ FeP ₂ ; FW: 594.59; orange powdr.	2g
	Note: Sold in collaboration with Solvias for research purposes only.	10g

Technical Note:

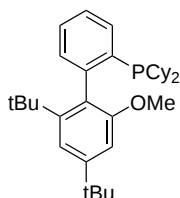
1. See 26-1230 (page 173)

PHOSPHORUS - Ligands and Compounds

15-1105

NEW

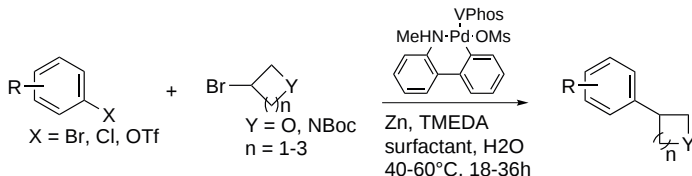
2-Dicyclohexylphosphino-2'-methoxy-4',6'-di-*t*-butyl-1,1'-biphenyl, min. 98% VPhos (1848244-75-6)
 $C_{33}H_{49}OP$; FW: 492.72; white to off-white solid
 Note: Patents: US 6,395,916, US 6,307,087



250mg
1g
5g

Technical Note:

- Ligand for the palladium catalyzed aqueous Lipshutz-Negishi cross-coupling of alkyl halides with aryl electrophiles.



Tech. Note (1)
Ref. (1)

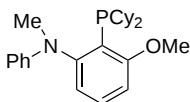
References:

- Angew. Chem. Int. Ed.*, **2016**, 55, 1849

15-6528

NEW

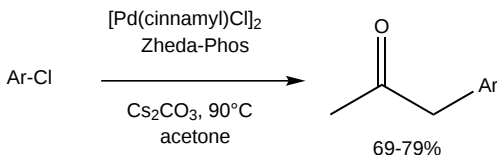
[2-Dicyclohexylphosphino-3-methoxy-N-methyl-N-phenylbenzenamine, 98% Zheda-Phos (1398565-95-1)]
 $C_{26}H_{38}NOP$; FW: 409.54; white powdr.;
 m.p. 169-170°
 Note: Sold under license from ZJU for research purposes only. Patent CN201210146220.6, PCT/CN2012/078129.



250mg
1g

Technical Note:

- Ligand/Pd catalyst used in the general α -monoarylation of acetone with aryl chlorides.



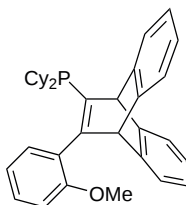
Tech. Note (1)
Ref. (1)

References:

- Adv. Synth. Catal.*, **2013**, 355, 1255.

15-1082

11-Dicyclohexylphosphino-12-(2-methoxy-phenyl)-9,10-ethenoanthracene dichloro-methane adduct, min. 98% o-MeO-KITPHOS (1166994-78-0)
 $C_{35}H_{39}OP$; FW: 506.66; white powdr.
 Note: Sold under license from NCL for research purposes only. Patent Pending.



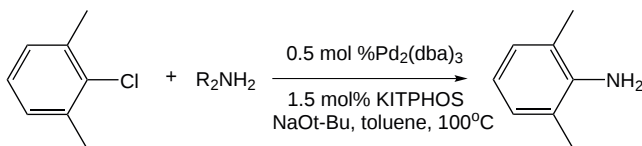
100mg
500mg

Technical Notes:

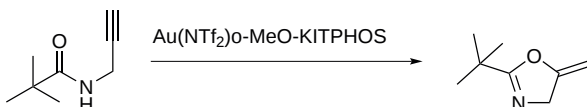
- Useful ligand for the Palladium-catalyzed amination reaction.
- Useful ligand for Gold(I)-triflimide catalyzed intramolecular cyclizations.

PHOSPHORUS - Ligands and Compounds

15-1082 (continued) **11-Dicyclohexylphosphino-12-(2-methoxyphenyl)-9,10-ethenoanthracene dichloromethane adduct, min. 98% o-MeO-KITPHOS (1166994-78-0)**



Tech. Note (1)
Ref. (1)

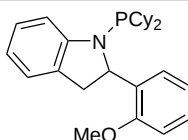


Tech. Note (2)
Ref. (2)

References:

1. *Adv. Synth. Catal.*, **2008**, 350, 1808.
2. *Adv. Synth. Catal.*, **2009**, 351, 576.

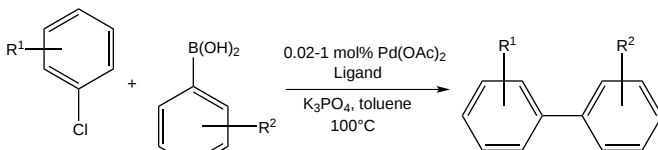
15-1087 **1-(Dicyclohexylphosphino)-2-(2-methoxyphenyl)-1H-indole, min. 98% NPCy o-Andole-Phos (947402-60-0)**
 $\text{C}_{27}\text{H}_{34}\text{NOP}$; FW: 419.54; white to off-white powdr.; m.p. 131.1-132.5°



100mg
500mg

Technical Note:

1. Suzuki-Miyaura Coupling of Aryl and Hetero-aryl Chlorides.



$\text{R}^1 = \text{Me, MeO, NH}_2, \text{CO}_2\text{Me, COMe, pyr}$; $\text{R}^2 = \text{Me, Np, Bu}$

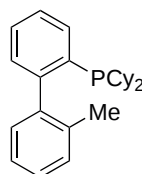
up to 99% yield

Tech. Note (1)
Ref. (1)

References:

1. *Org. Lett.* **2007**, 9, 2795.
2. *J. Org. Chem.*, **2012**, 77, 3543.

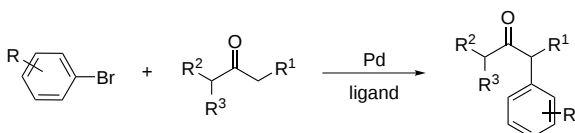
15-1148 **2-Dicyclohexylphosphino-2'-methyl-1,1'-biphenyl, min. 98% MePhos (251320-86-2)**
 $\text{C}_{28}\text{H}_{33}\text{P}$; FW: 364.51; white xtl.; m.p. 107-110°
Note: Buchwald Biaryl Phosphine Ligand Master Kit component. Buchwald Biaryl Phosphine Ligand Mini Kit 2 component. Patents: US 6,395,916, US 6,307,087.



500mg
2g
10g
50g

Technical Notes:

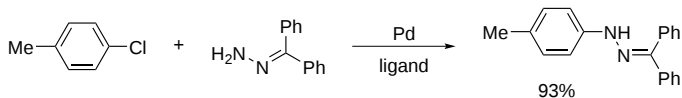
1. Ligand used for the Pd-catalyzed formation of α -arylketones
2. Ligand used for the Pd-catalyzed amination reaction (see 15-1045).^[5]
3. Ligand used for the Pd-catalyzed hydrazone arylation
4. Ligand used for the Pd-catalyzed synthesis of 5,5-disubstituted butenolides.
5. Ligand used for the Pd-catalyzed direct arylation of polyfluorinated arenes at room temperature.



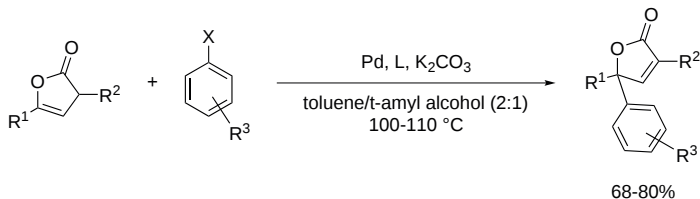
Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

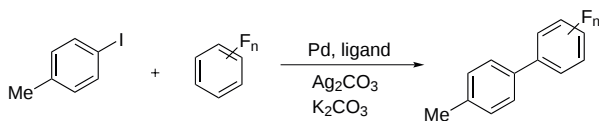
15-1148 2-Dicyclohexylphosphino-2'-methyl-)-1,1'-biphenyl, min. 98% MePhos (251320-86-2)
(continued)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

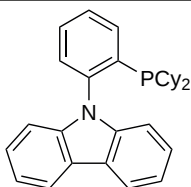


Tech. Note (4)
Ref. (4)

References:

1. *J. Am. Chem. Soc.*, **2000**, *122*, 1360.
2. *Adv. Synth. Catal.*, **2007**, *347*, 773.
3. *Org. Lett.*, **2009**, *11*, 2663.
4. *Org. Lett.*, **2010**, *12*, 2116.
5. *Chem. Sci.*, **2011**, *2*, 27.

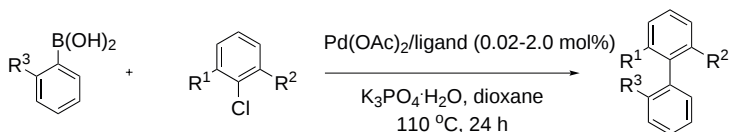
15-0445 9-[2-(Dicyclohexylphosphino)phenyl]-9H-carbazole, min. 98%
PhenCar-Phos (1308652-64-3)
 $C_{30}H_{34}NP$; FW: 439.57; white powdr.
air sensitive
Note: PhenCar-Phos Ligand Kit component.



250mg
1g

Technical Note:

1. Carbazolyl-derived phosphine ligand used in the highly efficient, catalytic coupling of sterically hindered aryls.



Tech. Note (1)
Ref. (1)

References:

1. *Chem. Commun.*, **2011**, *47*, 5079.

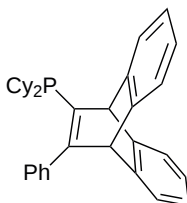
PHOSPHORUS - Ligands and Compounds

15-1084

11-Dicyclohexylphosphino-12-phenyl-9,10-ethenoanthracene dichloromethane adduct, min. 98% KITPHOS
(1166994-77-9)

C₃₄H₃₇P; FW: 476.63; white powdr.

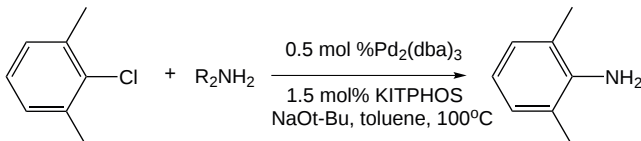
Note: Sold under license from NCL for research purposes only. Patent Pending.



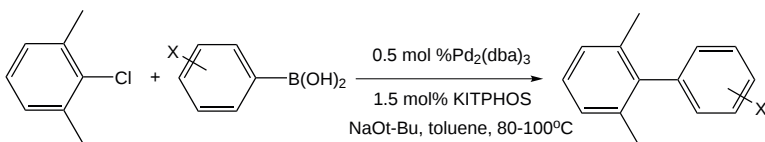
100mg
500mg

Technical Notes:

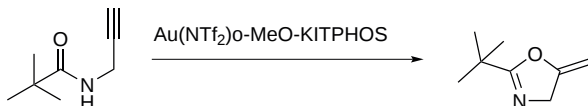
1. Useful ligand for the palladium-catalyzed amination reaction.
2. Useful ligand for the palladium-catalyzed Suzuki cross-coupling reaction.
3. Useful ligand for Gold(I)-triflimide catalyzed intramolecular cyclizations.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (1,2)



Tech. Note (3)
Ref. (3)

References:

1. *Adv. Synth. Catal.*, **2008**, 350, 1801.
2. *Adv. Synth. Catal.*, **2010**, 352, 201.
3. *Adv. Synth. Catal.*, **2009**, 351, 576.

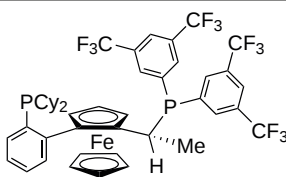
26-1120

(R)-(+)-1-[(R)-2-(2'-Dicyclohexylphosphinophenyl)ferrocenyl]ethylbis(3,5-trifluoromethylphenyl)phosphine, min. 97%
(821009-34-1)

C₄₆H₄₄F₁₂FeP₂; FW: 942.62; orange powdr.

(store cold)

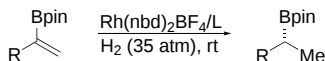
Note: Sold in collaboration with Solvias for research purposes only. Solvias Walphos Ligand Kit component.



100mg
500mg
2g
10g

Technical Note:

1. Ligand for Rh-catalyzed hydrogenation of vinylboronic esters.



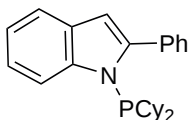
Tech. Note (1)
Ref. (1)

References:

1. *Org. Lett.*, **2006**, 8, 2413

PHOSPHORUS - Ligands and Compounds

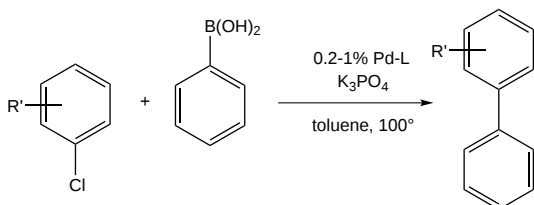
15-1089 **1-(Dicyclohexylphosphino)-2-phenyl-1H-indole, min. 98%**
NPCy Phendole-Phos (947402-57-5)
 $C_{26}H_{32}NP$; FW: 389.51;
 white to off-white powdr.



100mg
 500mg

Technical Note:

1. Suzuki-Miyaura Coupling of Aryl and Hetero-aryl Chlorides.

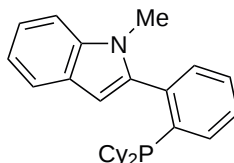


Tech. Note (1)
Ref. (1)

References:

1. *Org. Lett.*, **2007**, 9, 2795.

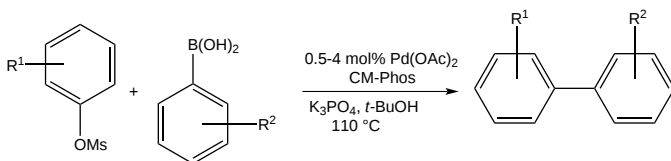
15-1088 **2-[2-(Dicyclohexylphosphino)phenyl]-1-methyl-1H-indole, min. 98%**
CM-Phos (1067883-58-2)
 $C_{27}H_{34}NP$; FW: 403.54;
 white to off-white powdr.;
 m.p. 171.9-174.9°



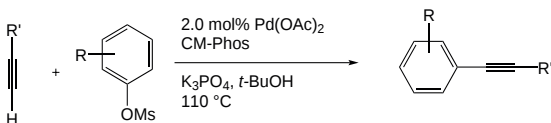
100mg
 500mg

Technical Notes:

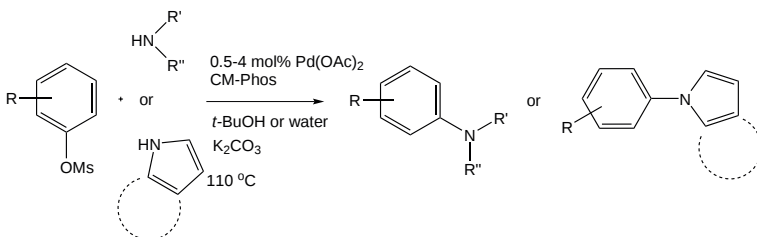
1. Suzuki-Miyaura Coupling of Aryl Mesylates and alkenyl triflate and mesylate bearing alkyl, methoxy, aldehyde, keto, nitrile, ester, and heteroaryl substitution.
2. Sonogashira Coupling of Aryl Mesylates, R' = alkyl, aryl; R = C(O)R, COOMe, CHO, CN.
3. Buchwald-Hartwig Amination of Aryl Mesylates, R = cyano, chloro, methoxy, keto, ester and etc.
4. Additional catalyzed reactions include Cyanation of functional Aryl Mesylates and Chlorides (Ref. 4,5); Hiyma Coupling of Aryl Mesylates (Ref. 6); Direct Arylation of Heterocycles with Aryl Mesylates (Ref. 7); Borylation of Aryl Mesylates (Ref. 8).



Tech. Note (1)
Ref. (1)



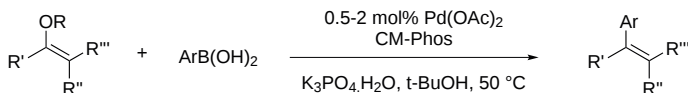
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

PHOSPHORUS - Ligands and Compounds

15-1088 **2-[2-(Dicyclohexylphosphino)phenyl]-1-methyl-1H-indole, min. 98% CM-Phos**
(continued) **(1067883-58-2)**



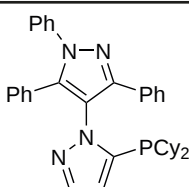
OR = OTs, OMs

Tech. Note (1)
Ref. (9)

References:

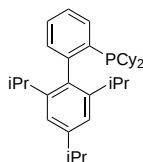
1. *Angew. Chem. Int. Ed.*, **2008**, 47, 8059.
2. *Chem. Eur. J.*, **2010**, 16, 9982.
3. *Angew. Chem. Int. Ed.*, **2008**, 47, 6402.
4. *Angew. Chem. Int. Ed.*, **2010**, 49, 8918.
5. *Org. Lett.*, **2011**, 13, 648.
6. *Org. Lett.*, **2009**, 11, 317.
7. *Chem. Eur. J.*, **2011**, 17, 761.
8. *Chem. Eur. J.*, **2011**, 17, 6913.
9. *Chem. Commun.*, **2011**, 47, 8328.

15-1039 **5-(Dicyclohexylphosphino)-1',3',5'-triphenyl-[1,4']-bi-1H-pyrazole, min. 95% Cy-BippyPhos (1021176-69-1)**
 $C_{36}H_{39}N_4P$; FW: 558.70; white powd.
air sensitive



250mg
 1g

15-1149 **2-(Dicyclohexylphosphino)-2',4',6'-tri-*i*-propyl-1,1'-biphenyl, min. 98% XPhos (564483-18-7)**
 $C_{33}H_{49}P$; FW: 476.72; white powd.; m.p. 185°
 Note: Buchwald Biaryl Phosphine Ligand Master Kit component. Buchwald Biaryl Phosphine Ligand Mini Kit 1 component. Patents: US 6,395,916, US 6,307,087.



500mg
 2g
 10g
 100g
 500g

Technical Notes:

1. See also 46-0268.
2. Exceptional ligands for Pd-catalyzed amination and amidation of aryl sulfonates. [16]
3. Ligand used for the Pd-catalyzed Suzuki-Miyaura coupling reaction and carbonyl enolate coupling [9].
4. Ligand used for the chemoselective amination of aryl chlorides.
5. Ligand used for the Pd-catalyzed borylation of aryl chlorides. (For the formation of trifluoroborates, see also Ref. 11)
6. Ligand used for the Pd-catalyzed amination of vinyl halides and triflates.
7. Ligand used for the Pd-catalyzed three-component synthesis of indoles.
8. Ligand used for the Pt-catalyzed regioselective hydrosilylation of functionalized terminal arylalkynes.
9. Ligand used for the Pd-catalyzed synthesis of carbazoles.
10. Ligand used for the Pd-catalyzed Suzuki-Miyaura coupling of aryl chloride and NHC-boranes.
11. Ligand used for the direct arylation of picoline N-oxide.
12. Ligand used for the Negishi coupling of 2-heterocyclic organozinc reagents.
13. Catalyst for a phosphine-catalyzed Heine reaction.
14. Ligand used for the palladium-catalyzed oxidative coupling of indoles and heteroarenes.
15. Ligand used for the silver-catalyzed hydrogenation of aldehydes.
16. Ligand used for the palladium-catalyzed cyanation of heterocyclic halides.

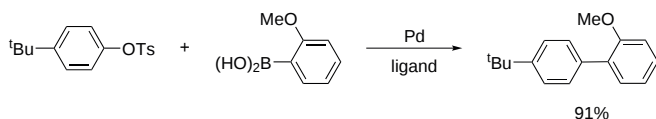


R,R' = *n*-Butyl: 88%
 R = C(O)Me, R' = H: 88%

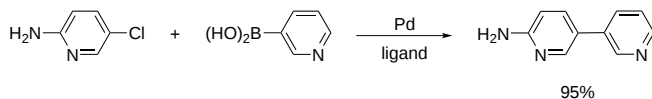
Tech. Note (2)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

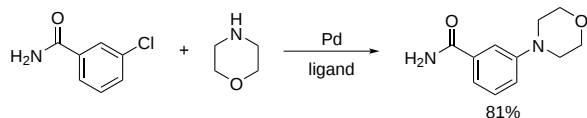
15-1149 2-(Dicyclohexylphosphino)-2',4',6'-tri-*i*-propyl-1,1'-biphenyl, min. 98% XPhos
(continued) (564483-18-7)



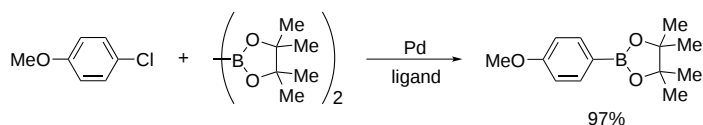
Tech. Note (3)
Ref. (2)



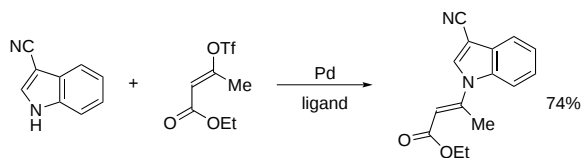
Tech. Note (3)
Ref. (3,4)



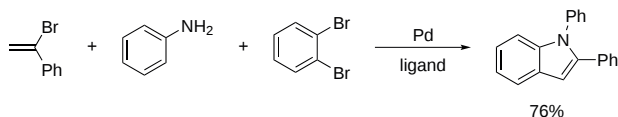
Tech. Note (4)
Ref. (3)



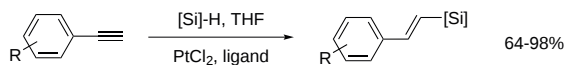
Tech. Note (5)
Ref. (5)



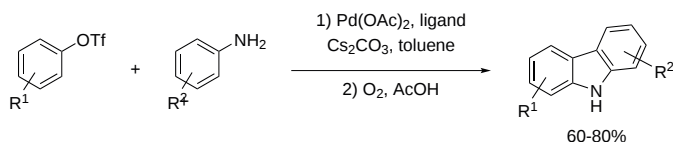
Tech. Note (6)
Ref. (6)



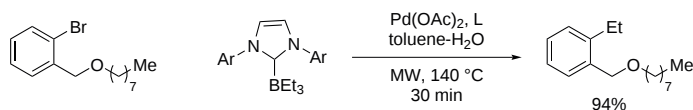
Tech. Note (7)
Ref. (7)



Tech. Note (8)
Ref. (8)



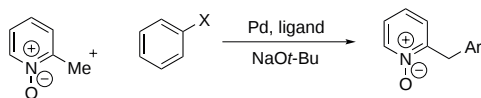
Tech. Note (9)
Ref. (10)



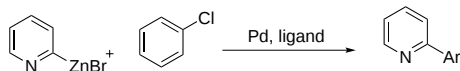
Tech. Note (10)
Ref. (10)

PHOSPHORUS - Ligands and Compounds

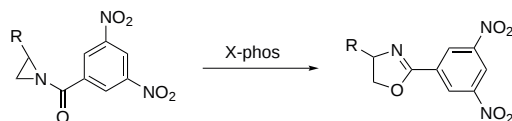
15-1149 **2-(Dicyclohexylphosphino)-2',4',6'-tri-*i*-propyl-1,1'-biphenyl**, min. 98% XPhos
(continued) (564483-18-7)



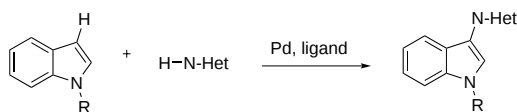
Tech. Note (11)
Ref. (12)



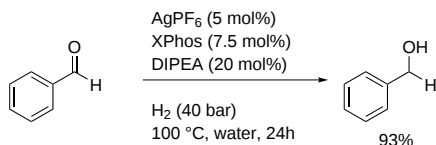
Tech. Note (12)
Ref. (13)



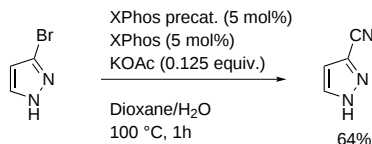
Tech. Note (13)
Ref. (14)



Tech. Note (14)
Ref. (15)



Tech. Note (15)
Ref. (16)

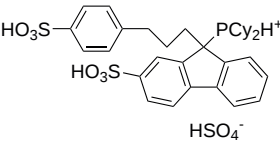
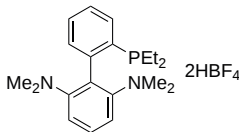


Tech. Note (16)
Ref. (17)

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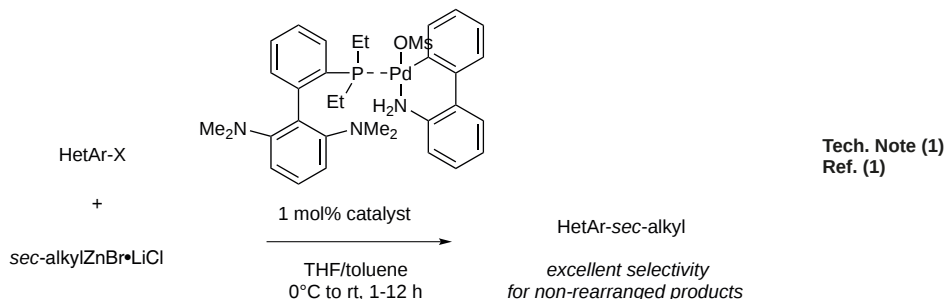
1. *J. Am. Chem. Soc.*, **2003**, 125, 6653.
2. *J. Am. Chem. Soc.*, **2003**, 125, 11818.
3. *Angew. Chem. Int. Ed.*, **2006**, 45, 6523.
4. *J. Am. Chem. Soc.*, **2007**, 129, 3358.
5. *Angew. Chem. Int. Ed.*, **2007**, 46, 5359.
6. *J. Org. Chem.*, **2005**, 70, 8638.
7. *Angew. Chem. Int. Ed.*, **2007**, 46, 1529.
8. *Tetrahedron Lett.*, **2008**, 49, 2429.
9. *Acc. Chem. Res.* **2008**, 41, 1461.
10. *J. Org. Chem.*, **2009**, 74, 4720.
11. *Org. Lett.*, **2009**, 11, 4914.
12. *J. Am. Chem. Soc.*, **2010**, 132, 17701.
13. *J. Org. Chem.*, **2010**, 75, 8330.
14. *Org. Lett.*, **2011**, 13, 5444.
15. *Angew. Chem., Int. Ed.*, **2011**, 50, 5365.
16. *Chem. Sci.*, **2011**, 2, 27.
17. *Angew. Chem., Int. Ed.*, **2013**, 52, 11871.
18. *Angew. Chem., Int. Ed.*, **2013**, 52, 10035.

PHOSPHORUS - Ligands and Compounds

15-1078	Dicyclohexyl-[9-[3-(4-sulfonylphenyl)propyl]-2-sulfonylfluoren-9-yl] phosphonium hydrogen sulfate, min. 95% [cataCXium® FSulf] $C_{34}H_{43}O_{10}PS_3$; FW: 738.87 Note: Sold in collaboration with Solvias for research purposes only. Patent Application Pending. Solvias cataCXium® Ligand Kit component.	 500mg 2g
15-1130	Dicyclopentylphosphine, 97+% (39864-68-1) $(C_5H_9)_2PH$; FW: 170.23; colorless liq.; d. 0.933 <i>air sensitive, pyrophoric</i>	1g 5g
15-1131	Dicyclopentylphosphine, 97+% (10 wt% in hexanes) (39864-68-1) $(C_5H_9)_2PH$; FW: 170.23; colorless liq. <i>air sensitive</i>	10g 50g
15-1150	Diethylchlorophosphine, min. 95% (686-69-1) $(C_2H_5)_2PCl$; FW: 124.55; colorless to light yellow liq.; b.p. 131-132°; f.p. 66°F; d. 1.023 <i>air sensitive, moisture sensitive, (store cold)</i>	1g 5g
93-1520	Di-(2-ethylhexyl)phosphoric acid (contains some mono) (298-07-7) $[C_8H_{19}CH(C_2H_5)CH_2O]_2P(O)(OH)$; FW: 322.42; colorless liq.; d. 0.974	100g 500g
15-1210	Diethylphosphine, 99% (627-49-6) $(C_2H_5)_2PH$; FW: 90.11; colorless liq.; b.p. 85°; d. 0.7862 <i>pyrophoric, STENCH</i>	1g 5g
15-1211	Diethylphosphine, 99% (10 wt% in hexanes) (627-49-6) $(C_2H_5)_2PH$; FW: 90.11; colorless liq.; d. 0.66 <i>air sensitive</i>	10g 50g
15-1151	2-Diethylphosphino-2',6'-bis(dimethylamino)-1,1'-biphenyl di(hydrogen tetrafluoroborate) salt, min. 98% EtCPhos $C_{20}H_{29}N_2P_2 \cdot 2(HBF_4)$; FW: 504.01; white powdr. Note: Patents: US 6,395,916, US 6,307,087.	 100mg 500mg

Technical Note:

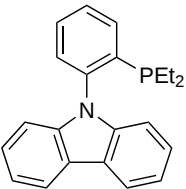
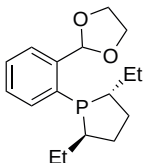
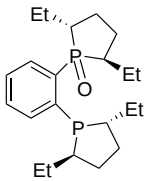
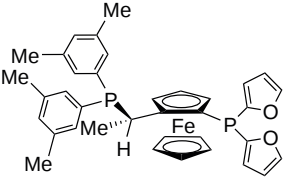
- Ligand used in palladium-catalyzed cross-coupling of secondary alkylzinc reagents with heteroaryl halides



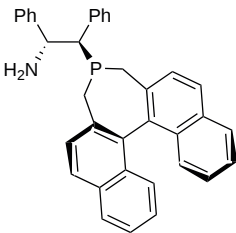
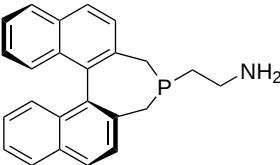
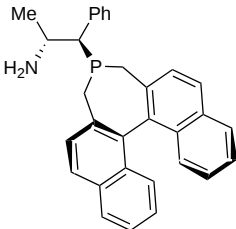
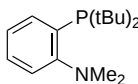
References:

- Org. Lett., **2014**, 16, 4638 (Note this reference is for is for 46-0348, EtCPhos Palladacycle Gen. 3.)

PHOSPHORUS - Ligands and Compounds

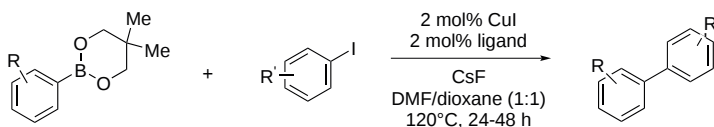
15-0496	9-[2-(Diethylphosphino)phenyl]-9H-carbazole, min. 97% Et PhenCar-Phos (1308652-66-5) $C_{22}H_{22}NP$; FW: 331.39; white powdr. <i>air sensitive</i> Note: PhenCar-Phos Ligand Kit component.		100mg 500mg
93-1521	Diethylphosphite, min. 95% (762-04-9) $(C_2H_5O)_2P(O)H$; FW: 138.11; colorless liq.; b.p. 50-51°/2 mm; f.p. 195°F; d. 1.072		100g 500g
15-7332	2-[2-[(2R,5R)-2,5-Diethyl-1-phospholano]phenyl]1,3-dioxolane, min. 97% $C_{17}H_{25}O_2P$; FW: 292.35; pale yellow to colorless liq. <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.		100mg 500mg
15-7333	2-[2-[(2S,5S)-2,5-Diethyl-1-phospholano]phenyl]1,3-dioxolane, min. 97% (1217655-83-8) $C_{17}H_{25}O_2P$; FW: 292.35; pale yellow to colorless liq. <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.		100mg 500mg
15-7354	[1-(2R,5R)-2,5-Diethylphospholanyl]-[2-(2R,5R)-2,5-diethylphospholanyl-1-oxide]benzene, min. 97% (924294-55-3) $C_{22}H_{36}OP_2$; FW: 378.47; pale yellow to colorless liq. <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.		100mg 500mg
15-7355	[1-(2S,5S)-2,5-Diethylphospholanyl]-[2-(2S,5S)-2,5-diethylphospholanyl-1-oxide]benzene, min. 97% $C_{22}H_{36}OP_2$; FW: 378.47; pale yellow to colorless liq. <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.		100mg 500mg
93-1571 HAZ	Difluorophosphoric acid hemihydrate, tech. gr. (13779-41-4) $HPO_2F_2 \cdot 0.5H_2O$; FW: 101.98 (110.99); yellow fuming liq.; m.p. -96.5°; b.p. 115.9°; d. 1.583 (25°)		250g 1kg
26-1170	(S)-(+)-1-[(R)-2-(Di-2-furylphosphino)ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97% (649559-66-0) $C_{36}H_{36}FeO_2P_2$; FW: 618.46; orange powdr. Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.		100mg 500mg 2g 10g

PHOSPHORUS - Ligands and Compounds

15-7137	(1R,2R)-2-[(4S,11bR)-3,5-Dihydro-4H-dinaphtho[2,1-c:1',2'-e]phosphepin-4-yl]-1,2-diphenylethanamine, min. 97% (1469882-57-2) $C_{36}H_{30}NP$; FW: 507.60; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO 2008148202.		100mg 500mg
15-7136	(1S,2S)-2-[(4R,11bS)-3,5-Dihydro-4H-dinaphtho[2,1-c:1',2'-e]phosphepin-4-yl]-1,2-diphenylethanamine, min. 97% (1092064-02-2) $C_{36}H_{30}NP$; FW: 507.60; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO 2008148202.		100mg 500mg
15-7134	2-[(11bS)-3,5-Dihydro-4H-dinaphtho[2,1-c:1',2'-e]phosphepin-4-yl]ethylamine, min. 97% (1053659-64-5) $C_{24}H_{22}NP$; FW: 355.41; pale yellow solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO2008148202.		100mg 500mg
15-7141	(1R,2R)-2-[(4S,11bR)-3,5-Dihydro-4H-dinaphtho[2,1-c:1',2'-e]phosphepin-4-yl]-1-phenylpropan-2-amine, min. 97% (1092064-04-4) $C_{31}H_{28}NP$; FW: 445.53; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO 2008148202.		100mg 500mg
15-7140	(1S,2S)-2-[(4R,11bS)-3,5-Dihydro-4H-dinaphtho[2,1-c:1',2'-e]phosphepin-4-yl]-1-phenylpropan-2-amine, min. 97% (1092064-04-4) $C_{31}H_{28}NP$; FW: 445.53; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO 2008148202.		100mg 500mg
15-1260	[2-(N,N-Dimethylamino)phenyl]di-t-butylphosphine, min. 95% (415941-58-1) $C_{16}H_{28}NP$; FW: 265.37; white to light-brown xtl.; m.p. 50-53° Note: Ligand used in the copper-catalyzed coupling of arylboronate esters with aryl and heteroaryl halides.		1g 5g

Technical Notes:

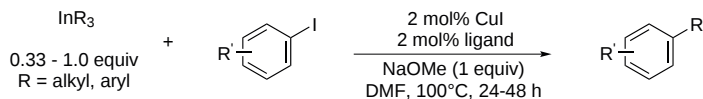
- Ligand for the Copper-Catalyzed Suzuki-Miyaura Coupling of Arylboronate Esters and Aryl Iodides
- Ligand for the Copper-Catalyzed Coupling of Triaryl- and Trialkylindium reagents with Aryl Iodides and Bromides



Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-1260 [2-(N,N-Dimethylamino)phenyl]di-t-butylphosphine, min. 95% (415941-58-1)
(continued)

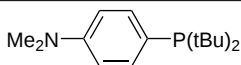


Tech. Note (2)
Ref. (2)

References:

1. *Org. Lett.*, **2014**, 16, 1264
2. *Angew. Chem. Int. Ed.*, **2014**, 53, 11620

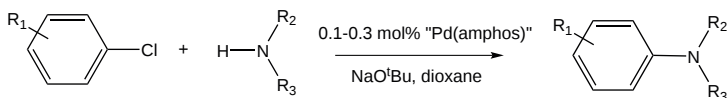
15-1248 [4-(N,N-Dimethylamino)phenyl]di-t-butylphosphine, min. 95% amphos
(932710-63-9)
 $\text{C}_{16}\text{H}_{28}\text{NP}$; FW: 265.37; white to light-brown xtl.; m.p. 57-61°



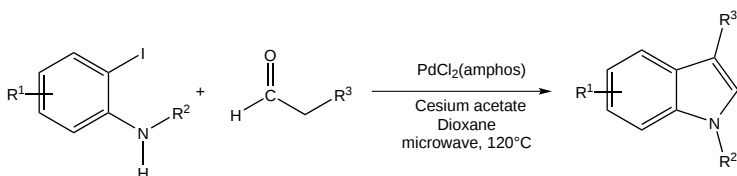
1g
5g
25g

Technical Notes:

1. Ligand used in a highly-active palladium precatalyst for the efficient amination of aryl chloride.
2. Ligand used in the palladium-catalyzed annulations under microwave enhanced conditions.



Tech. Note (1)
Ref. (1)

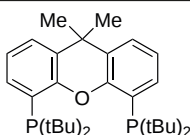


Tech. Note (2)
Ref. (2)

References:

1. *Organometallics*, **2011**, 30, 4432.
2. *Tetrahedron Letters*, **2013**, 54, 5126.

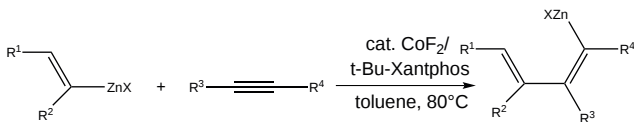
15-1241 9,9-Dimethyl-4,5-bis(di-t-butylphosphino)xanthene, min. 97% t-Bu-XANTPHOS
(856405-77-1)
 $\text{C}_{31}\text{H}_{48}\text{OP}_2$; FW: 498.66; white to light yellow pwr.



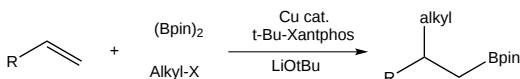
500mg
2g

Technical Notes:

1. Ligand used in the cobalt-catalyzed alkenylzincation of unfunctionalized alkynes.
2. Ligand used in the cobalt-catalyzed alkylboration of alkenes
3. Ligand used in the palladium-catalyzed N-alkylation of amines using primary and secondary alcohols
4. Ligand used in the palladium-catalyzed methylation of alkynyl C(sp)-H bonds with dimethyl sulfonium ylides



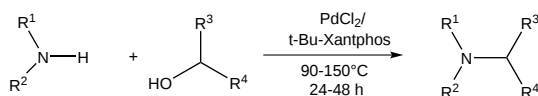
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Ref. (1)



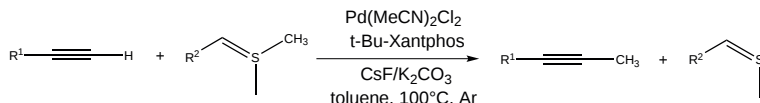
Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

15-1241 **9,9-Dimethyl-4,5-bis(di-t-butylphosphino)xanthene, min. 97% t-Bu-XANTPHOS**
(continued) (856405-77-1)



Tech. Note (3)
Ref. (3)

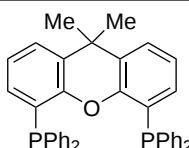


Tech. Note (4)
Ref. (4)

References:

1. *Angew. Chem. Int. Ed.*, **2016**, 55, 336
2. *Angew. Chem. Int. Ed.*, **2015**, 54, 12961.
3. *ACS Catalysis*, **2013**, 3, 2536.
4. *J. Org. Chem.*, **2013**, 78, 10421.

15-1242 **9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS**
(161265-03-8)
 $\text{C}_{39}\text{H}_{32}\text{OP}_2$; FW: 578.63; light-yellow xtl.;
m.p. 221-222°



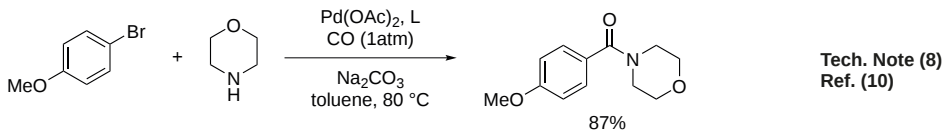
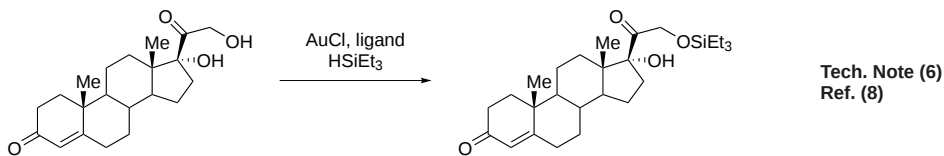
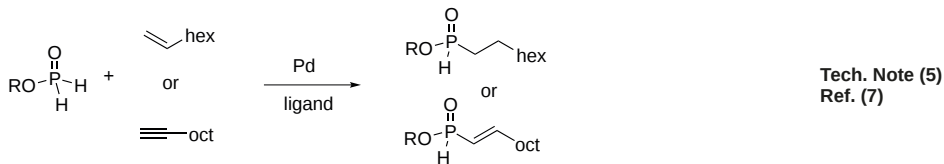
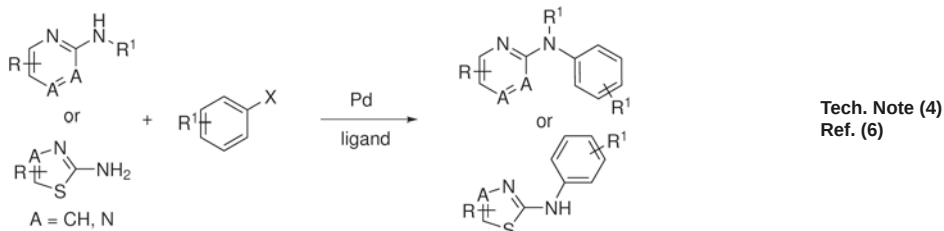
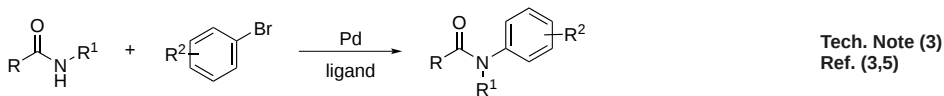
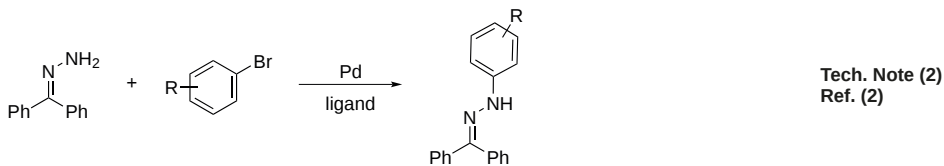
1g
5g
25g
100g

Technical Notes:

1. Ligand used for the hydroformylation of alkenes.
2. Ligand used for the hydroformylation of alkenes.
3. Ligand used in the intermolecular coupling of amides and hydrazones with aryl halides.
4. Ligand used in the intermolecular coupling of amides with aryl halides or triflates.
5. Ligand used in the coupling of heteroaryl amines and aryl halides.
6. Ligand used in the hydrophosphinylation of alkenes and alkynes.
7. Ligand used for the Au(I)-catalyzed dehydrogenative silylation of alcohols.
8. Ligand used for the sulfinylation of aryl iodides.
9. Ligand used for the Pd-catalyzed carbonylation reaction of aryl bromides and amines.
10. Ligand used for the Ni-catalyzed alkyne cyanation of alkynes.
11. Ligand used for the Pd-catalyzed N-arylation of 3-amino-1H-pyrazole.
12. Ligand used for the Rh-catalyzed dehydrogenative borylation of cyclic alkenes.
13. Ligand used for the Pd-catalyzed intermolecular coupling of H-Phosphonate diesters with benzyl halides.
14. Ligand used for the Pd-catalyzed one pot synthesis of 4-aryl-1H-1,2,3-triazoles.
15. Ligand used for the Pd-catalyzed intermolecular addition of formamides to alkynes.
16. Ligand used for the Pd-catalyzed decarboxylative couplings of 2-(2-azaaryl)acetates with aryl halides and triflates.
17. Ligand used for the Pd-catalyzed benzylic arylation of 2-methyl azaarenes.
18. Ligand used for the Pd-catalyzed α-arylation of heteroaromatic ketones.
19. Ligand used for the Pd-catalyzed direct alkylation of both azoles and azolines.
20. Ligand used for the Cu-catalyzed intermolecular coupling of alkynes with aryl iodides.
21. Ligand used for the Pd-catalyzed ene-type reaction of aldehydes with 1,3-diene.
22. Ligand used for the Pd-catalyzed ene-type reaction of aldehydes with 1,3-diene.
23. Ligand used for the Pd/Cu-catalyzed direct arylation of heteroarenes.
24. Ligand used for the Pd-catalyzed reaction of propargyl-substituted malonate esters with aryl halides.
25. Ligand used for the Pd-catalyzed decarboxylative coupling of tertiary cyanoacetate salts with aryl halides and triflates.
26. Ligand used for the Pd-catalyzed hydroesterification of alkynes.
27. Ligand used for the Cu-catalyzed arylation of arylboronic acids with aldehydes.
28. Ligand used for the Ru-catalyzed oxidative synthesis of heterocycles from alcohols.
29. Ligand used for the Rh-catalyzed borylation of nitriles.
30. Ligand used in the Pd-catalyzed α-arylation of benzylic phosphine oxides.
31. Ligand used in the Pd-Catalyzed Oxidative Coupling of Enamides and Alkynes.
32. Ligand used in the Pd-catalyzed difunctionalization of enol ethers to amino acetals with aminals and alcohols.
33. Ligand used in the Pd-catalyzed alkoxy carbonylation of α-chloroketones.

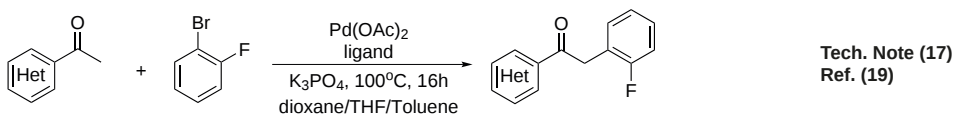
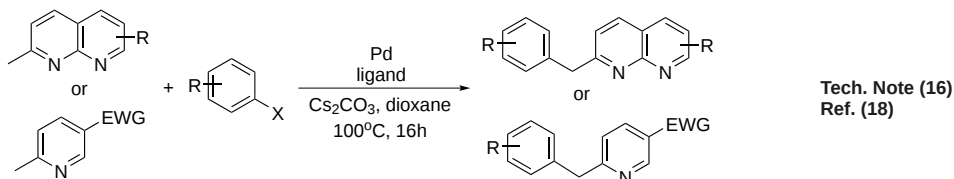
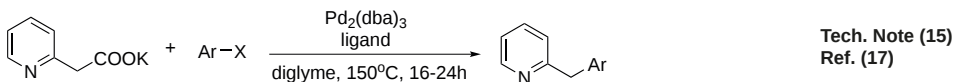
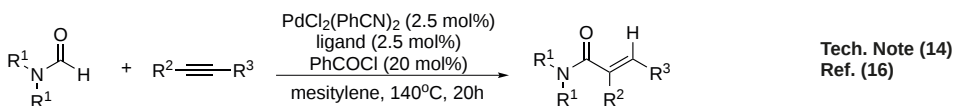
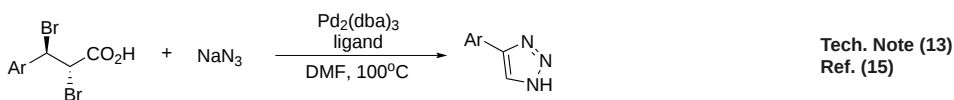
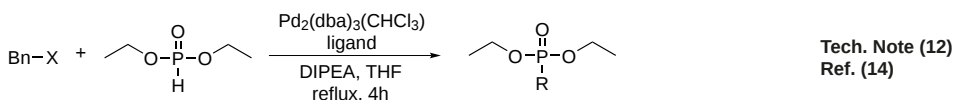
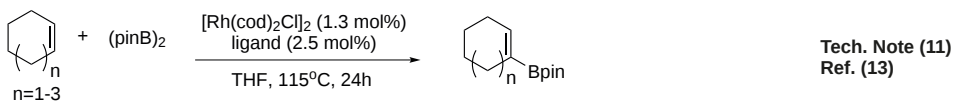
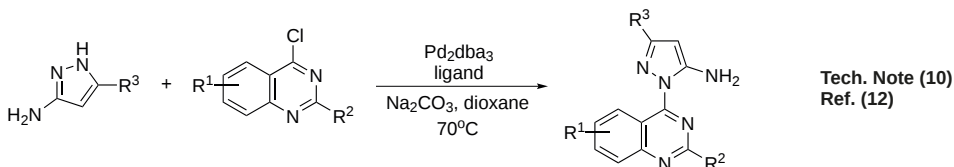
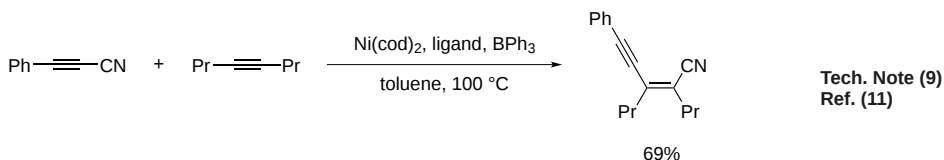
PHOSPHORUS - Ligands and Compounds

15-1242 (continued)	9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS
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PHOSPHORUS - Ligands and Compounds

15-1242 9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS
(continued)

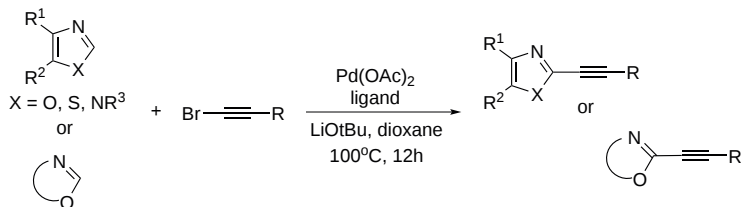


PHOSPHORUS - Ligands and Compounds

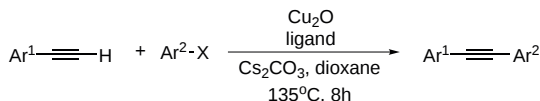
15-1242

9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS

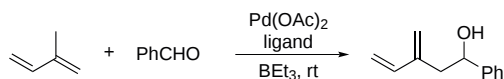
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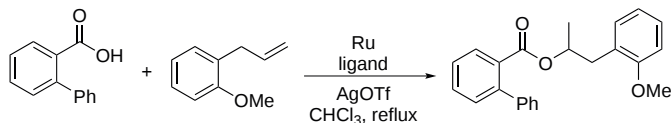
Tech. Note (18)
Ref. (20)



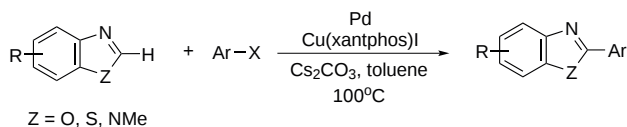
Tech. Note (19)
Ref. (21)



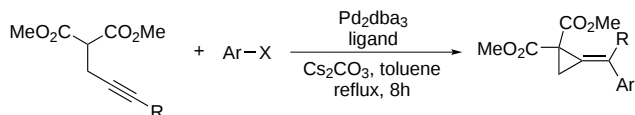
Tech. Note (20)
Ref. (22)



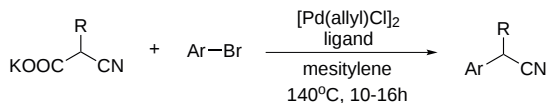
Tech. Note (21)
Ref. (23)



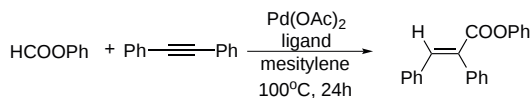
Tech. Note (22)
Ref. (24)



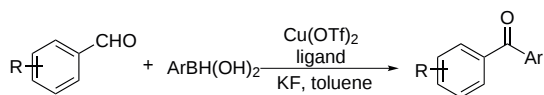
Tech. Note (23)
Ref. (25)



Tech. Note (24)
Ref. (26)



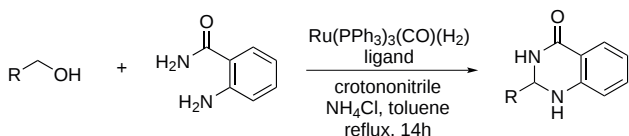
Tech. Note (25)
Ref. (27)



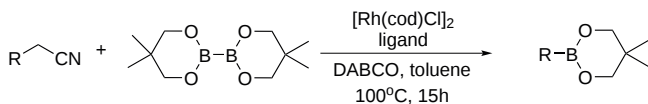
Tech. Note (26)
Ref. (28)

PHOSPHORUS - Ligands and Compounds

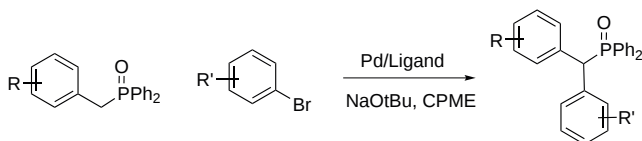
15-1242 9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS
(continued)



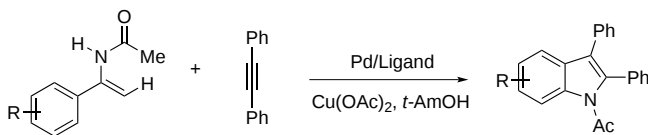
Tech. Note (27)
Ref. (29)



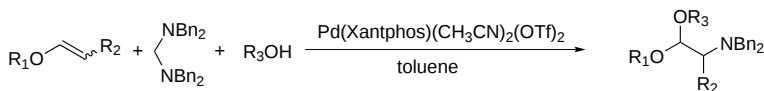
Tech. Note (28)
Ref. (30)



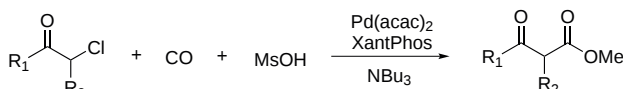
Tech. Note (29)
Ref. (31)



Tech. Note (30)
Ref. (32)



Tech. Note (31)
Ref. (33)



Tech. Note (32)
Ref. (34)

References:

1. Organometallics, 1995, 14, 3081.
2. J. Am. Chem. Soc., 1999, 121, 10251.
3. Org. Lett., 2000, 2, 1101.
4. Acc. Chem. Res., 2001, 34, 895 (review).
5. J. Am. Chem. Soc., 2002, 124, 6043.
6. Org. Lett., 2002, 4, 3481.
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10. J. Org. Chem., 2008, 73, 7102.
11. Tetrahedron, 2009, 65, 5037.
12. Org. Lett., 2010, 12, 552.
13. Chem. Commun., 2010, 46, 907.
14. New J. Chem., 2010, 34, 967.
15. Synthesis, 2010, 2, 283.
16. J. Am. Chem. Soc., 2010, 132, 2094.
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20. Org. Lett., 2010, 12, 1868.
21. Eur. J. Org. Chem., 2010, 4368.
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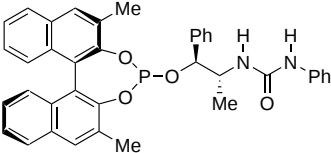
PHOSPHORUS - Ligands and Compounds

15-1242 9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, min. 98% XANTPHOS

(continued)

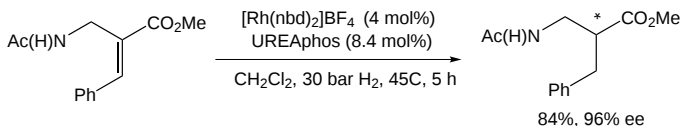
23. Tetrahedron Letters, 2010, 51, 2806.
24. J. Am. Chem. Soc., 2010, 132, 3674.
25. J. Am. Chem. Soc., 2011, 133, 9682.
26. Angew. Chem. Int. Ed., 2011, 50, 4470.
27. Adv. Synth. Catal., 2011, 353, 475.
28. Synlett, 2011, 11, 1626.
29. Org. Biomol. Chem., 2012, 10, 240.
30. J. Am. Chem. Soc., 2012, 134, 115.
31. Org. Lett., 2014, 16, 130.
32. Org. Lett., 2014, 16, 608.
33. J. Am. Chem. Soc., 2013, 135, 18327.
34. Adv. Synth. Catal., 2012, 354, 3105

15-1250	Dimethylchlorophosphine, min. 97% (811-62-1)	1g
amp	(CH ₃) ₂ PCl; FW: 96.50; colorless to pale yellow liq. (may contain some solids);	5g
HAZ	b.p. 76-77°; f.p. -1°F; d. 1.22	
	<i>moisture sensitive, pyrophoric</i>	

15-2206	1-[(1S,2R)-1-[(11bR)-2,6-Dimethyldinaphtho[2,1-d':1',2'-f][1,3,2]dioxaphosphepin-4-yloxy]-1-phenylpropan-2-yl]-3-phenylurea, min. 97% (1858223-86-5)	50mg 250mg
	C ₃₈ H ₃₃ N ₂ O ₄ P; FW: 612.65; white powdr. <i>moisture sensitive, (store cold)</i> Note: Sold under license from InCatT for research purposes only. WO2004/103559. UREAPhos and METAMORPhos Ligand Kit component.	
		

Technical Note:

1. The UREAphos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



References:

1. J. Chem. Soc. Chem. Comm., 2007, 864.
2. WO2004103559A2.

PHOSPHORUS - Ligands and Compounds

15-2204

**1-((2S)-1-[(11bS)-2,6-Dimethyl-
ydinaphtho[2,1-d:1',2'-f]
[1,3,2]dioxaphos-
phopin-4-yloxy]propan-2-
yl)-3-phenylurea, min. 97%**
(1357562-63-0)

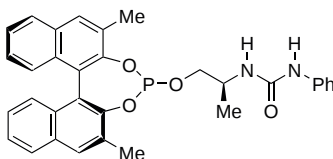
C₃₂H₂₉N₂O₄P; FW: 536.56;
white powdr.

moisture sensitive, (store cold)

Note: Sold under license from
InCatT for research purposes
only. WO2004/103559.

UREAphos and

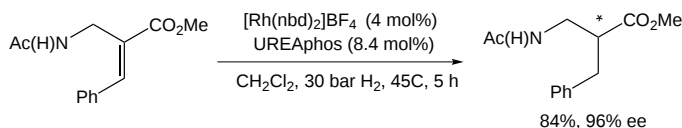
METAMORPhos Ligand Kit
component.



50mg
250mg

Technical Note:

1. The UREAphos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



References:

1. J. Chem. Soc. Chem. Comm., **2007**, 864.
2. WO2004103559A2,

15-1255

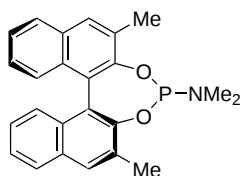
**(S)-(+)-(2,6-Dimethyl-3,5-dioxa-4-phos-
pha-cyclohepta[2,1-a;3,4-a']dinaph-
thalen-4-yl)dimethylamine, min. 98%**
(185449-86-9)

C₂₄H₂₂NO₂P; FW: 387.41; off-white powdr.;

m.p. 228-229°

moisture sensitive

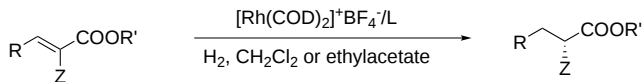
Note: Sold in collaboration with DSM
for research purposes only. Patent WO
0204466. DSM's MonoPhos™ Ligand
Kit component.



100mg
500mg

Technical Notes:

1. Ligand used in the enantioselective, rhodium-catalyzed hydrogenation of substituted olefins, such as N-acetyldihydroamino acids, enamides, and unsaturated acids.
2. Ligand used in the enantioselective, iridium-catalyzed allylic substitution of allyl acetates containing only a single substituent in the 1 or 3 position
3. Ligand use in the rhodium-catalyzed, amide directed, asymmetric hydroboration reaction
4. Ligand used in asymmetric conjugate addition of aryl boronic acids to dihydronitronaphthalenes.
5. Ligand used in the rhodium-catalyzed asymmetric intramolecular 1,4 addition.



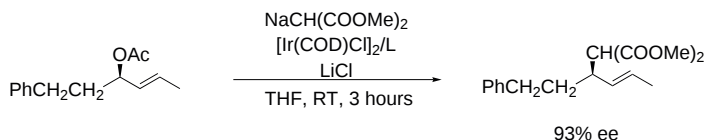
R = H, Ph R' = H, CH₃ Z = NHCOCH₃, CH₂COOH

>97% ee

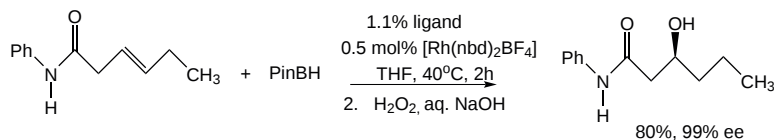
**Tech. Note (1)
Ref. (1-3)**

PHOSPHORUS - Ligands and Compounds

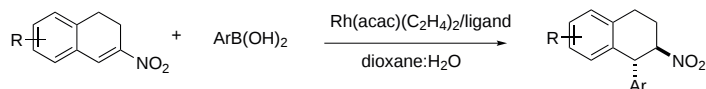
15-1255 (S)-(+)-(2,6-Dimethyl-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dime-
(continued) thylamine, min. 98% (185449-86-9)



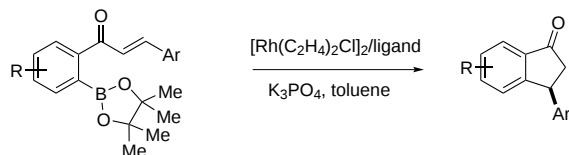
Tech. Note (2)
Ref. (4,5)



Tech. Note (3)
Ref. (6)



Tech. Note (4)
Ref. (7)

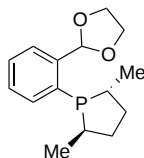


Tech. Note (4)
Ref. (8)

References:

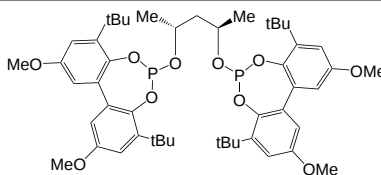
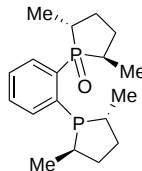
1. J. Am. Chem. Soc., **2000**, 122, 11539.
2. Adv. Synth. Catal., **2003**, 345, 308.
3. Adv. Synth. Catal., **2002**, 344, 1003.
4. Chem. Comm, **1999**, 741.
5. Eur. J. Inorg. Chem., **2002**, 2569
6. J. Am. Chem. Soc., **2008**, 130, 3734.
7. Ad. Synth. Catal, **2012**, 354, 2433.
8. J. Org. Chem., **2013**, 78, 2736.

15-1280	Dimethyldiphenylphosphonium iodide, 98% (1017-88-5) (CH ₃) ₂ (C ₆ H ₅) ₂ P ⁺ I ⁻ ; FW: 342.16; white xtl. <i>hygroscopic</i>	5g 25g
93-1523	Dimethylmethylphosphonate, 97% (756-79-6) (CH ₃ O) ₂ P(O)(CH ₃); FW: 124.08; colorless liq.; b.p. 92-97°/50 mm; f.p. 156°F; d. 1.160	100g 500g 2kg
15-1400 amp HAZ	Dimethylphenylphosphine, 99% (672-66-2) (CH ₃) ₂ (C ₆ H ₅)P; FW: 138.15; colorless liq.; b.p. 75-79°/12 mm; f.p. 122°F; d. 0.967 <i>air sensitive</i>	2g 10g
15-1425	Dimethylphosphine oxide, min. 97% (7211-39-4) C ₂ H ₅ OP; FW: 78.05; white solid <i>air sensitive</i>	500mg 2g
15-7335	2-{2-[(2R,5R)-2,5-Dimethyl-1-phospholano]phenyl}1,3-dioxolane, min. 97% (1044256-04-3) C ₁₆ H ₂₁ O ₃ P; FW: 264.30; pale yellow to colorless liq. <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg



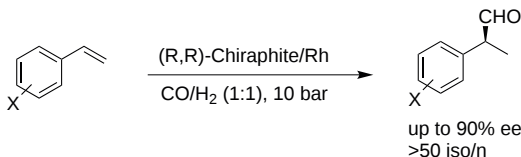
PHOSPHORUS - Ligands and Compounds

15-7336	2-{2-[(2S,5S)-2,5-Dimethyl-1-phospholano]phenyl}1,3-dioxolane, min. 97% (695816-47-8) C ₁₅ H ₂₁ O ₃ P; FW: 264.30; pale yellow to colorless liq. <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg
15-7360	[1-(2R,5R)-2,5-Dimethylphospholanyl]-[2-(2R,5R)-2,5-dimethylphospholanyl-1-oxide]benzene, min. 97% (638132-66-8) C ₁₈ H ₂₈ OP ₂ ; FW: 322.36; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg
15-7361	[1-(2S,5S)-2,5-Dimethylphospholanyl]-[2-(2S,5S)-2,5-dimethylphospholanyl-1-oxide]benzene, min. 97% (1380079-15-1) C ₁₈ H ₂₈ OP ₂ ; FW: 322.36; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only.	100mg 500mg
15-1455	(+)-6,6'-[[(1R,3R)-1,3-Dimethyl-1,3-propanediyl]bis(oxy)]bis[4,8-bis(t-butyl)-2,10-dimethoxy-benzo[d,f][1,3,2]dioxaphosphepin], min. 95% (R,R)-Chiraphite (149646-83-3) C ₄₀ H ₆₆ O ₁₀ P ₂ ; FW: 876.99; off-white powdr. <i>air sensitive, moisture sensitive</i> Note: Sold in collaboration with Chirotech for research purposes only. US Patent No. 5,491,266.	100mg 500mg



Technical Note:

- Useful catalyst for the asymmetric hydroformylation of olefins under mild conditions. High enantio- and regioselectivities have been demonstrated for several prochiral vinylarenes, and a wide variety of functional groups can be tolerated.



References:

- J. Org. Chem., **2004**, 69, 4031.
- Organometallics, **1997**, 16, 2929.
- J. Chem. Soc., Dalton Trans., **1995**, 409.
- J. Am. Chem. Soc., **2005**, 127, 5040.

15-1456	(-)-6,6'-[[(1S,3S)-1,3-Dimethyl-1,3-propanediyl]bis(oxy)]bis[4,8-bis(t-butyl)-2,10-dimethoxy-bibenzo[d,f][1,3,2]dioxaphosphepin], min. 95% (S,S)-Chiraphite (852042-07-0) C ₄₀ H ₆₆ O ₁₀ P ₂ ; FW: 876.99; off-white powdr. <i>air sensitive, moisture sensitive</i> Note: Sold in collaboration with Chirotech for research purposes only. US Patent 5,491,266.	100mg 500mg
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Technical Note:

- See 15-1455 (page 194)

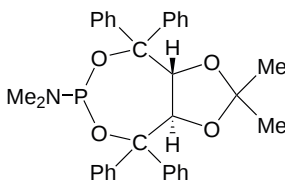
PHOSPHORUS - Ligands and Compounds

15-1505

(3aR,8aR)-(-)-(2,2-Dimethyl-4,4,8,8-tetraphenyl-tetrahydro-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphin-6-yl)dimethylamine, min. 98% (213843-90-4)

C₃₃H₃₄NO₄P; FW: 539.60; white powdr.; m.p. 218-221°
moisture sensitive

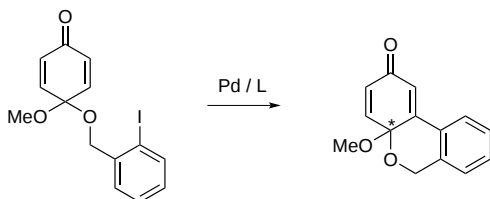
Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.



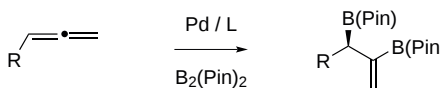
100mg
500mg

Technical Notes:

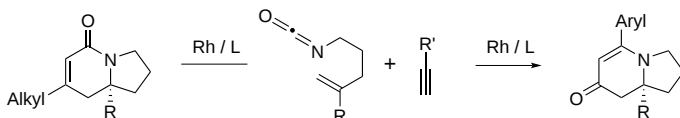
1. Monodentate ligand for the enantioselective intramolecular reaction of prochiral cyclohexadienones.
2. Ligand use in the palladium-catalyzed, enantioselective diboration of allenes.
3. Enantioselective Rh-catalyzed [2+2+2] cycloaddition of alkynes and isocyanates.
4. Palladium-catalyzed enantioselective C-H arylation.
5. Palladium-catalyzed dynamic kinetic cross-coupling.
6. Palladium-catalyzed enantioselective C-H arylation.



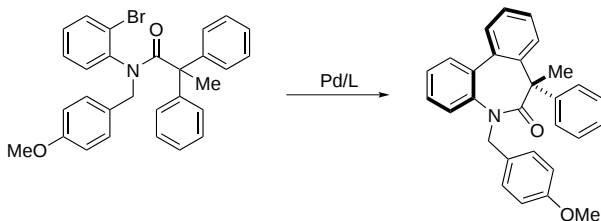
Tech. Note (1)
Ref. (1)



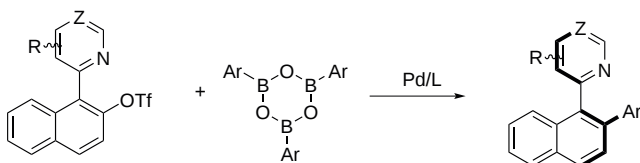
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



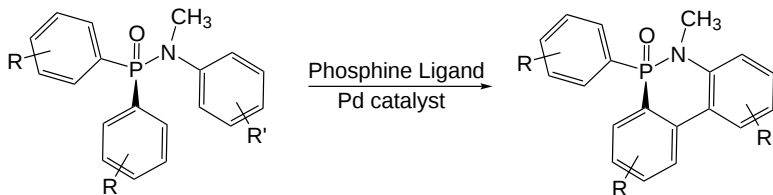
Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

PHOSPHORUS - Ligands and Compounds

15-1505 (continued) (3aR,8aR)-(-)-(2,2-Dimethyl-4,4,8,8-tetraphenyl-tetrahydro-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepin-6-yl)dimethylamine, min. 98% (213843-90-4)

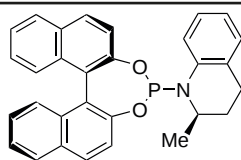


Tech. Note (6)
Ref. (6)

References:

1. *J. Am. Chem. Soc.*, **2002**, 124, 184.
2. *J. Am. Chem. Soc.*, **2004**, 126, 16328.
3. *Org. Lett.*, **2008**, 10, 1231.
4. *Angew. Chem. Int. Ed.*, **2013**, 52, 7865.
5. *J. Am. Chem. Soc.*, **2013**, 135, 15730.
6. *Angew. Chem. Int. Ed.*, **2015**, 54, 6265.

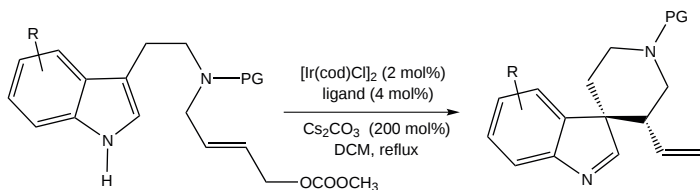
15-7203 (2R)-1-(11bR)-(Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yl)-2-methyl-1,2,3,4-tetrahydroquinoline, 98% (1186392-43-7)
C₃₀H₂₄NO₂P; FW: 461.49; yellow powdr. moisture sensitive
Note: Sold in collaboration with SIOC for research purposes only. Patent ZL200910048438.6.



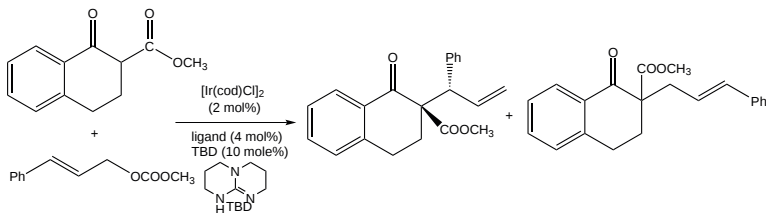
250mg
1g

Technical Notes:

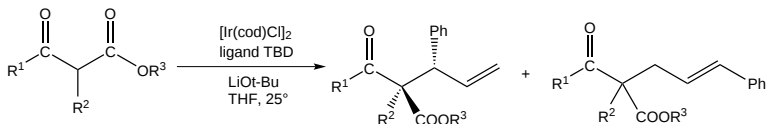
1. Chiral ligand used in the iridium-catalyzed formation of a chiral five-membered ring spiroindolenine.
2. Chiral ligand used in an iridium-catalyzed, enantioselective, allylic alkylation reaction.
3. Chiral ligand used in the iridium-catalyzed, enantioselective functional group substitution at the α-position of β-ketoesters.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

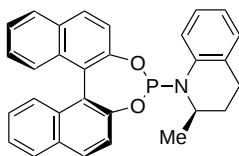
References:

1. *J. Am. Chem. Soc.*, **2010**, 132, 11419.
2. *J. Am. Chem. Soc.*, **2013**, 135, 10626.
3. *J. Am. Chem. Soc.*, **2013**, 135, 17298.

PHOSPHORUS - Ligands and Compounds

15-7204

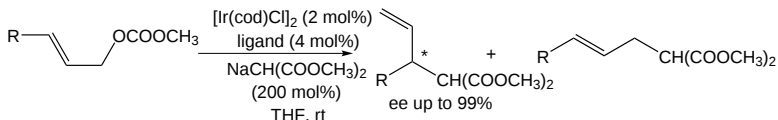
(2R)-1-(11bS)-(Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yl)-2-methyl-1,2,3,4-tetrahydroquinoline, 98% (1186392-32-4)
 $C_{30}H_{24}NO_2P$; FW: 461.49; white to off-white powdr.
moisture sensitive
 Note: Sold in collaboration with SIOC for research purposes only. Patent ZL200910048438.6.



250mg
1g

Technical Notes:

1. Chiral ligand used in the iridium-catalyzed, allylic alkylation reaction.
2. See 15-7203.



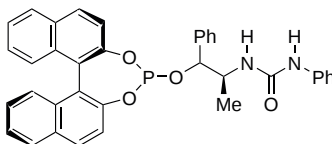
Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.*, **2012**, 134, 4812.

15-2202

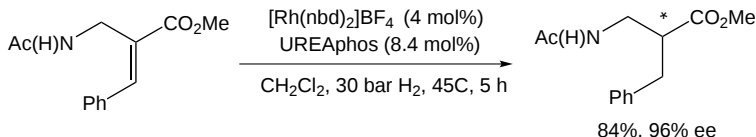
1-[(1R,2S)-1-[(11bR)-Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yloxy]-1-phenylpropan-2-yl]-3-phenylurea, min. 97% (1198080-55-5)
 $C_{36}H_{29}N_2O_4P$; FW: 584.60; white powdr.
moisture sensitive, (store cold)
 Note: Sold under license from InCatT for research purposes only. WO2004/103559.
 UREAPhos and METAMORPhos Ligand Kit component.



50mg
250mg

Technical Note:

1. The UREAPhos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



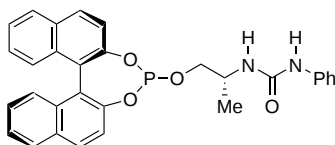
References:

1. *J. Chem. Soc. Chem. Comm.*, **2007**, 864.
2. WO2004103559A2.

PHOSPHORUS - Ligands and Compounds

15-2200

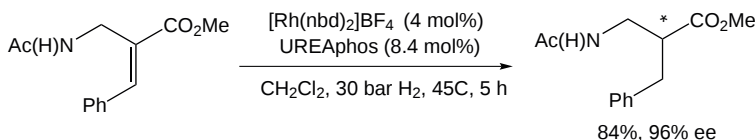
1-((2R)-1-[(11bR)-Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yloxy]propan-2-yl)-3-phenylurea, min. 97% UREAPhos (1198080-53-3)
 $C_{30}H_{25}N_2O_4P$; FW: 508.50; white powdr.
moisture sensitive, (store cold)
 Note: Sold under license from InCatT for research purposes only. WO2009/065856. UREAPhos and METAMORPhos Ligand Kit component.



50mg
250mg

Technical Note:

- The UREAPhos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



References:

- J. Chem. Soc. Chem. Comm., **2007**, 864.
- WO2004103559A2

15-2201

1-((2S)-1-[(11bR)-Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yloxy]propan-2-yl)-3-phenylurea, min. 97% (1357562-63-0)
 $C_{30}H_{25}N_2O_4P$; FW: 508.50; white powdr.
moisture sensitive, (store cold)
 Note: Sold under license from InCatT for research purposes only. WO2004/103559, WO2009/065853. UREAPhos and METAMORPhos Ligand Kit component.

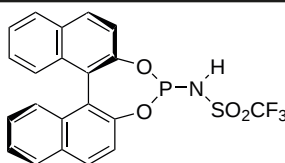
50mg
250mg

Technical Note:

- See 15-2200 (page 198)

15-2228

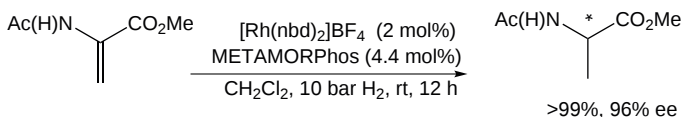
N-[(11bS)-Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yl]-1,1,1-trifluoromethanesulfonamide triethylamine adduct, min. 97% METAMORPhos (1493790-73-0)
 $C_{21}H_{13}F_3NO_4PS \cdot (C_2H_5)_3N$; FW: 564.56; white powdr.
moisture sensitive, (store cold)
 Note: Sold under license from InCatT for research purposes only. WO2009/065856. UREAPhos and METAMORPhos Ligand Kit component.



50mg
250mg

Technical Note:

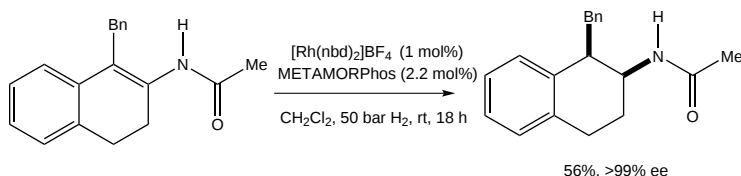
- Chiral ligand for the rhodium-catalyzed asymmetric hydrogenation of α - β unsaturated substrates.



**Tech. Note (1)
Ref. (1-3)**

PHOSPHORUS - Ligands and Compounds

15-2228 **N-[(11bS)-Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yl]-1,1,1-trifluoromethanesulfonylamide triethylamine adduct, min. 97% METAMORPhos (1493790-73-0)**

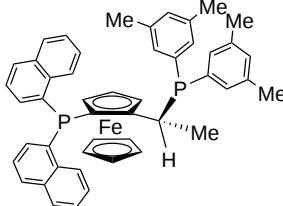


Tech. Note (1)
Ref. (1-3)

References:

1. *J. Am. Chem. Soc.*, **2009**, *131*, 6683.
2. *Angew. Chem. Int. Ed.*, **2008**, *47*, 3180.
3. Patent WO2009065856.

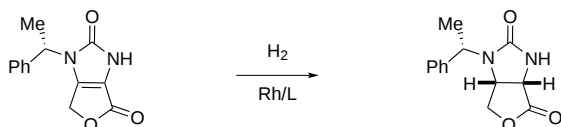
26-1175 **(R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino)ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97% (851308-40-2)**
C₄₈H₄₄FeP₂; FW: 738.68;
orange powdr.
Note: Sold in collaboration with Solvias for research purposes only.



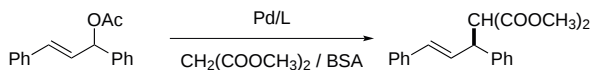
100mg
500mg
2g
10g

Technical Notes:

1. Ferrocenylphosphine ligands of the type cpFecp(PR₂)(*CH(CH₃)PR'₂) are a class of asymmetric ligands developed at Solvias in Basel, Switzerland¹. Ligands of this type are currently used industrially in the stereoselective synthesis of commercial products^{2,3}. A unique feature of these bidentate ligands is the presence of a fixed phosphine moiety and a stereogenic, functionalized side chain, which can be easily modified to accommodate electronic and steric requirements. Based on a versatile synthetic procedure starting with optically active ferrocenes of the type cpFecp(PR₂)(*CH(CH₃)X) [X = OAc or NR₂], a variety of donor atoms can be introduced into the side chain⁴. These ferrocene based phosphine ligands have wide application in the stereoselective hydrogenation of substituted acetamidoacrylates, enol acetates, β-ketoesters and simple alkenes⁵⁻⁹.
2. Useful as a ligand in Pd-catalyzed C-N bond-forming reactions.
3. Pd-catalyzed enantioselective alkylative desymmetrization of meso-succinic anhydrides.
4. Asymmetric hydrogenation of ketones and phosphinoylketimines.
5. Michael addition of Grignard reagents to α,β-unsaturated esters and thioesters
6. Boration of α,β-unsaturated esters and nitriles
7. Reaction of aryl halides with ammonia.
8. Cu-catalyzed reduction of activated C=C bonds with PMHS.
9. Regio- and enantioselective hydroboration of vinyl arenes.
10. Rh-catalyzed asymmetric ring-opening reactions of oxabicyclic alkenes.
11. 1,2-Migrations in Pd-catalyzed Negishi couplings with JosiPhos ligands.
12. Catalyst for the homodimerization of ketoketenes.
13. Ligand for the Rh catalyzed synthesis of lactones.
14. Ligand for the Cu-catalyzed synthesis of syn and anti γ-amino alcohols.



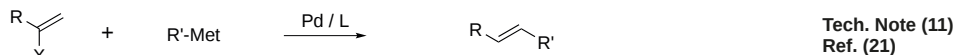
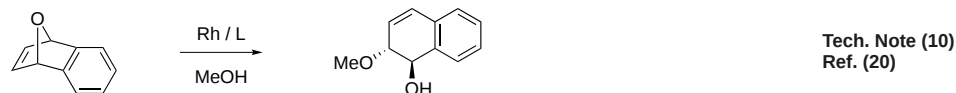
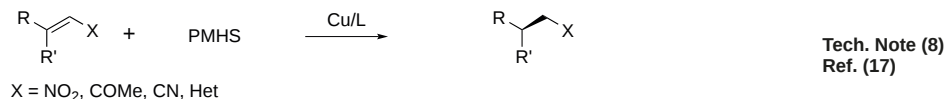
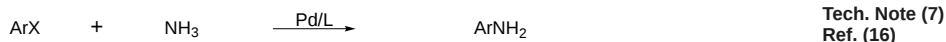
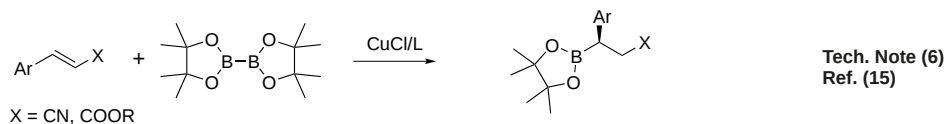
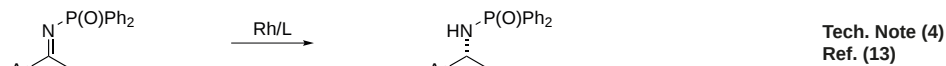
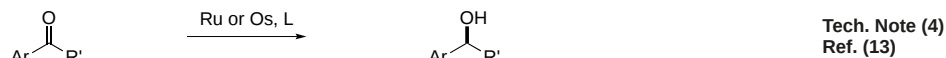
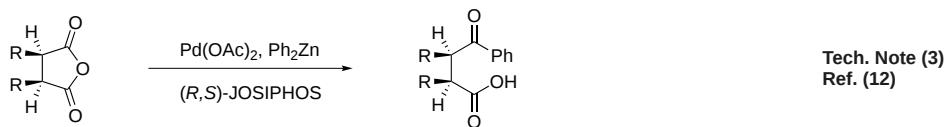
Tech. Note (1)
Ref. (3)



Tech. Note (1)
Ref. (5)

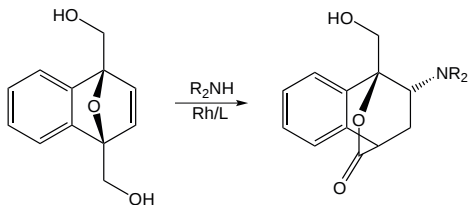
PHOSPHORUS - Ligands and Compounds

26-1175 (continued) (R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97% (851308-40-2)

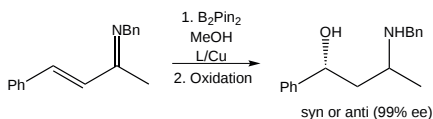


PHOSPHORUS - Ligands and Compounds

26-1175 (R)-(-)-1-[(S)-2-(Di-1-naphthylphosphino) ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97%
(continued) (851308-40-2)



Tech. Note (13)
Ref. (23)



Tech. Note (14)
Ref. (25)

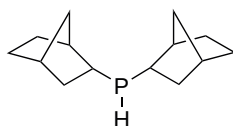
References:

1. Solvias owns the patent rights for Strem products **26, 1000, 26, 1001, 26, 1200, 26, 1201, 26, 1230, 26-1101**, and for the Ir and Rh complexes of the aforementioned products, including the complexes of **26-1210 and 26-1211**.
2. *C&E News*, July **22**, 1996, 38
3. *Angew. Chem. Int. Ed.*, **1996**, 35, 1475
4. *J. Org. Chem.*, **1972**, 37, 3052
5. *J. Am. Chem. Soc.*, **1994**, 116, 4062
6. *Inorg. Chim. Acta.*, **1994**, 222, 213
7. *Organometallics*, **1996**, 15, 860
8. *Helv. Chim. Acta.*, **1995**, 78, 883
9. *European Patents*; EP 624587 **A2**, 941117, EP, 612758, A1, 940831, EP, 564406, A1, 931006
10. *Comprehensive Asymmetric Catalysis*, **1999**, Chapter, 6.1, pg, 199, 207
11. *Topics in Catalysis*, March **2002**, 19, review
12. *J. Am. Chem. Soc.*, **2004**, 126, 10248
13. (a) *Angew. Chem. Int. Ed.*, **2007**, 46, 7651, (b) *Adv. Synth. Catal*, **2002**, 343, 68. (c) *J. Am. Chem. Soc.*, **2009**, 131, 10386.
14. *Angew. Chem. Int. Ed.*, **2005**, 44, 2752
15. *Angew. Chem. Int. Ed.*, **2007**, 47, 145
16. *J. Am. Chem. Soc.*, **2006**, 128, 10028
17. (a) *Angew. Chem. Int. Ed.*, **2003**, 42, 4793, (b) *Angew. Chem, Int, Ed*, **2006**, 45, 2785. (c) *J. Am. Chem. Soc.*, **2009**, 131, 10386.
18. *Angew. Chem. Int. Ed.*, **2006**, 45, 17674, review
19. *J. Am. Chem. Soc.*, **2004**, 126, 9200
20. *Proc. Natl. Acad. Sci. U.S.A.*, **2004**, 101, 5455
21. *J. Org. Chem.*, **2009**, 74, 135
22. *J. Org. Chem.* **2011**, 76, 7901
23. *Angew. Chem. Int. Ed.* **2011**, 50, 7346
24. *Review: Privileged Ligands and Catalysts*, **2011**, 93
25. *Angew. Chem. Int. Ed.* **2011**, 353, 376

15-1460



Di-2-norbornylphosphine, min. 98%
(mixture of endo and exo isomers)
(148432-44-4)
(C₇H₁₁)₂PH; FW: 222.31; colorless liq.;
d. 0.88
pyrophoric



1g
5g

15-1461

HAZ

Di-2-norbornylphosphine, min. 98% (mixture of endo and exo isomers)
(10 wt% in hexanes) (148432-44-4)
(C₇H₁₁)₂PH; FW: 222.31; colorless liq.
air sensitive

10g
50g

PHOSPHORUS - Ligands and Compounds

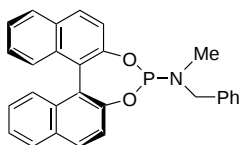
15-1510

(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)benzyl(methyl)amine, 99% (490023-37-5)

C₂₈H₂₂NO₂P; FW: 435.45; white powdr.; m.p. 155°

moisture sensitive

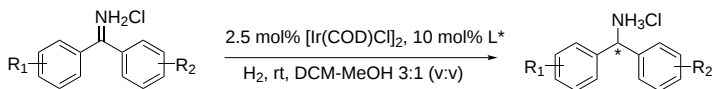
Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.



100mg
500mg

Technical Notes:

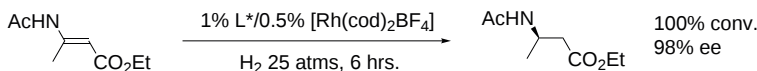
- The ligand has been used in Ir-catalyzed asymmetric hydrogenation of substituted benzophenone N-H imines
- The ligand has been used in the rhodium-catalyzed enantioselective hydrogenation of (E)-N-acylated dehydro-β-aminoacid esters (For (Z) isomer, use 15-1525).



R¹, R² = Me, OMe, CF₃, F, Cl, Br

80 - 96 % yield
76 - 98 % ee

Tech. Note (1)
Ref. (1)



100% conv.
98% ee

Tech. Note (2)
Ref. (2)

References:

- J. Am. Chem. Soc., **2010**, 132, 2124
- J. Am. Chem. Soc., **2002**, 124, 14552

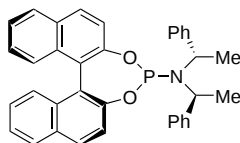
15-1521

(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl) bis[(1S)-1-phenylethyl]amine, min. 95% (380230-02-4)

C₃₆H₃₀NO₂P; FW: 539.60; off-white powdr.; m.p. 88-89°

moisture sensitive

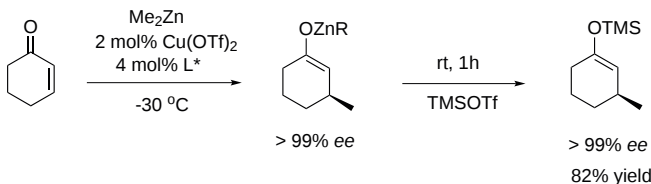
Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component..



100mg
500mg

Technical Notes:

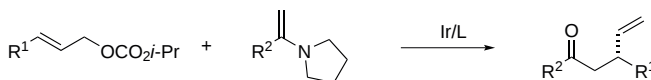
- A ligand for asymmetric conjugate addition of dialkyl zinc reagents to activated olefins.
- Iridium-catalyzed regioselective and enantioselective allylation of enamines.
- Iridium-catalyzed asymmetric allylation of KSAC.



> 99% ee

> 99% ee
82% yield

Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

15-1521 (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1S)-1-phenylethyl]amine, min. 95% (380230-02-4)



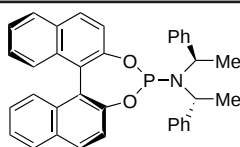
Tech. Note (3)
Ref. (3)

References:

1. *Org. Lett.*, **2002**, 4, 3835.
2. *J. Am. Chem. Soc.*, **2007**, 129, 7720.
3. *Eur. J. Org. Chem.*, **2013**, 2708.

15-1520

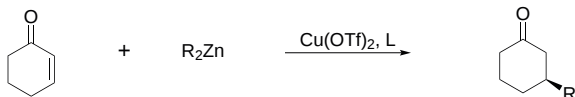
(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1R)-1-phenylethyl]amine, dichloromethane adduct, min. 95% (415918-91-1)
C₃₆H₃₀NO₂P; FW: 539.60; white powdr.; m.p. 102-103°
moisture sensitive
Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.



100mg
500mg

Technical Notes:

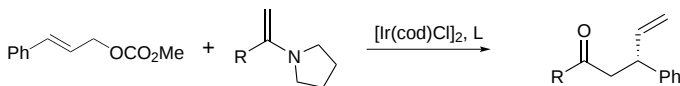
1. A ligand for asymmetric conjugate addition of dialkyl zinc reagents to activated olefins.
2. Ligand used in the iridium-catalyzed, enantioselective addition of nucleophiles to achiral allylic esters.
3. Asymmetric hydrogenation.
4. Ir-catalyzed regio- and enantioselective Friedel-Crafts allylic alkylation of indoles.
5. Asymmetric hydrovinylation.
6. Used in 1,3-dipolar cycloaddition reactions of azomethine ylides and alkenes,^{9a} and Rh-catalyzed [5+2] cycloaddition of alkyne-vinyl-cyclopropanes.^{9b}
7. Palladium-catalyzed enantioselective de-epimerization in catalytic asymmetric allylic alkylation.
8. Palladium-catalyzed enantioselective diamination of alkyl dienes.



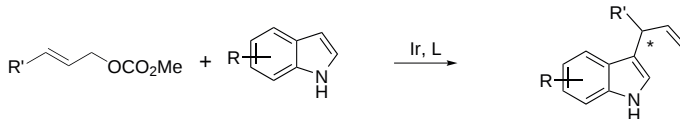
Tech. Note (1)
Ref. (1)



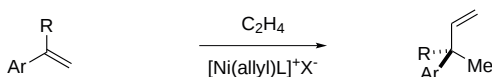
Tech. Note (2)
Ref. (2-4)



Tech. Note (2)
Ref. (5)



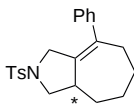
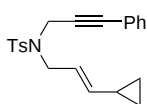
Tech. Note (4)
Ref. (7)



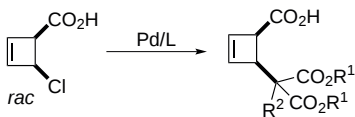
Tech. Note (5)
Ref. (8)

PHOSPHORUS - Ligands and Compounds

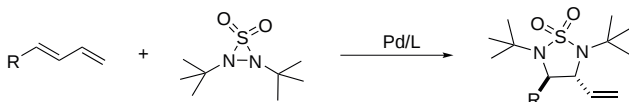
15-1520 (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1R)-1-phenyl-ethyl]amine, dichloromethane adduct, min. 95% (415918-91-1)



Tech. Note (6)
Ref. (9b)



Tech. Note (7)
Ref. (10)



Tech. Note (8)
Ref. (11)

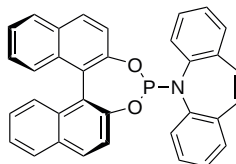
References:

1. *Angew. Chem. Int. Ed.*, **1997**, 36, 2620.
2. *J. Am. Chem. Soc.*, **2002**, 124, 15164.
3. *J. Am. Chem. Soc.*, **2003**, 125, 3426.
4. *Org. Lett.*, **2005**, 7, 1093.
5. *J. Am. Chem. Soc.*, **2007**, 129, 7720.
6. *Acc. Chem. Res.*, **2007**, 40, 1267.
7. *Org. Lett.*, **2008**, 10, 1815.
8. *Synthesis.*, **2009**, 2089.
9. (a) *Angew. Chem. Int. Ed.*, **2008**, 47, 6055. (b) *Chem. Eur. J.*, **2009**, 15, 8692.
10. *Angew. Chem. Int. Ed.*, **2012**, 51, 7314.
11. *Org. Lett.*, **2013**, 15, 796.

15-1227

NEW

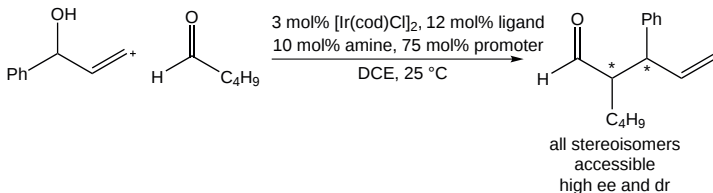
(S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)-5H-dibenz[b,f]azepine, min. 97% (942939-38-0)
C₃₄H₂₂NO₂P; FW: 507.52; yellow solid
air sensitive, moisture sensitive



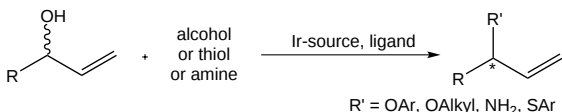
100mg
500mg

Technical Notes:

1. The ligand is used in the stereodivergent α -allylation of linear aldehydes with dual iridium and amine catalysis.
2. The ligand used in the direct, enantioselective iridium-catalyzed amination and (thio-) etherification of racemic allylic alcohols.
3. The ligand used in an asymmetric, rhodium-catalyzed, intramolecular hydroacylation reaction.



Tech. Note (1)
Ref. (1,2)

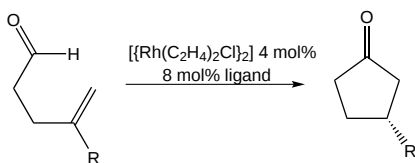


Tech. Note (2)
Ref. (3,4,5)

PHOSPHORUS - Ligands and Compounds

15-1227
(continued)

(S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)-5H-dibenz[b,f]azepine, min. 97% (942939-38-0)



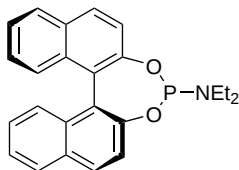
Tech. Note (3)
Ref. (6)

References:

1. *J. Am. Chem. Soc.*, **2014**, 136, 3020.
2. *Science*, **2013**, 340, 1065.
3. *Angew. Chem. Int. Ed.*, **2012**, 51, 3470.
4. *Angew. Chem. Int. Ed.*, **2012**, 51, 8652.
5. *Angew. Chem. Int. Ed.*, **2011**, 50, 5568.
6. *Angew. Chem. Int. Ed.*, **2011**, 50, 10670.

15-1231

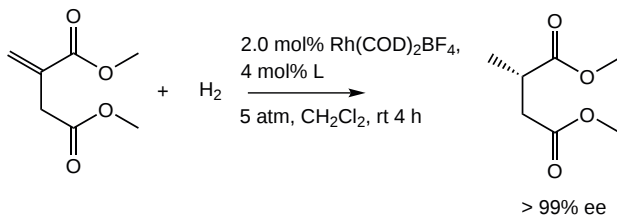
(S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl) diethylamine, min. 97% (252288-04-3)
C₂₄H₂₂NO₂P; FW: 387.41; white powd. moisture sensitive
Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.



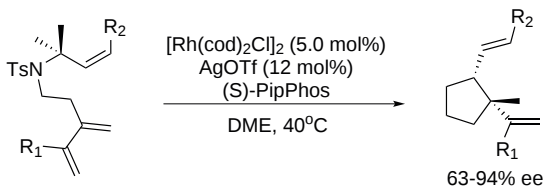
250mg
1g

Technical Notes:

1. See 15-1232.
2. Ligand used in the enantioselective rhodium catalyzed low pressure high activity hydrogenation of α -dehydroaminoesters, enamides, and dimethylitaconate.
3. Ligand used in enantioselective rhodium-catalyzed allylic C-H activation for addition to conjugated dienes.



Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)

References:

1. *J. Org. Chem.*, **2005**, 70, 943.
2. *Angew. Chem. Int. Ed.*, **2011**, 50, 2144.

PHOSPHORUS - Ligands and Compounds

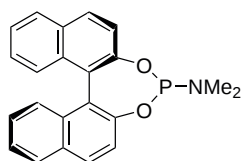
15-1232

(R)-(-)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dime-thylamine, min. 97% (R)-MONOPHOS (157488-65-8)

C₂₂H₁₈NO₂P; FW: 359.36; white xtl.; m.p. 190°

air sensitive

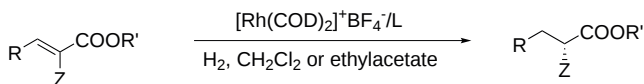
Note: Sold in collaboration with DSM for research purposes only. Patent no. WO02 04466. DSM's MonoPhos™ Ligand Kit component.



250mg
1g

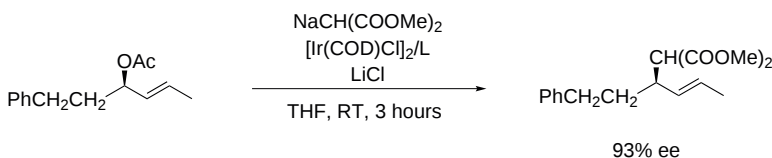
Technical Notes:

1. Ligand used in the enantioselective, rhodium-catalyzed hydrogenation of substituted olefins, such as N-acetyldihydroamino acids, enamides, and unsaturated acids.
2. Ligand used in the enantioselective, iridium-catalyzed allylic substitution of allyl acetates containing only a single substituent in the 1 or 3 position.
3. Ligand use in the rhodium-catalyzed, amide directed, asymmetric hydroboration reaction.
4. Ligand used in asymmetric conjugate addition of aryl boronic acids to dihydronitronaphthalenes.
5. Ligand used in the rhodium-catalyzed asymmetric intramolecular 1,4 addition.

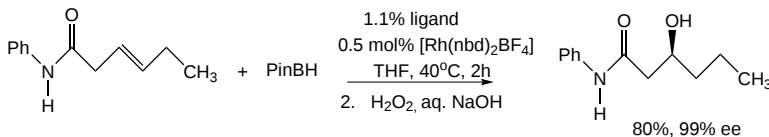


Tech. Note (1)
Ref. (1-3)

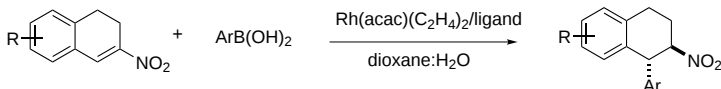
R = H, Ph R' = H, CH₃ Z = NHCOCH₃, CH₂COOH >97% ee



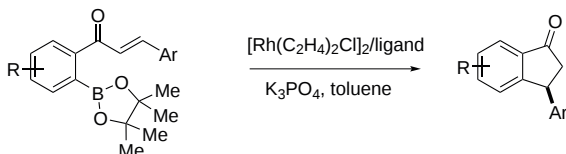
Tech. Note (2)
Ref. (4,5)



Tech. Note (3)
Ref. (6)



Tech. Note (4)
Ref. (7)



Tech. Note (4)
Ref. (8)

References:

1. J. Am. Chem. Soc., **2000**, 122, 11539.
2. Adv. Synth. Catal., **2003**, 345, 308.
3. Adv. Synth. Catal., **2002**, 344, 1003.
4. Chem. Comm, **1999**, 741.
5. Eur. J. Inorg. Chem., **2002**, 2569.
6. J. Am. Chem. Soc., **2008**, 130, 3734.
7. Adv. Synth. Catal, **2012**, 354, 2433.
8. J. Org. Chem., **2013**, 78, 2736.

PHOSPHORUS - Ligands and Compounds

15-1233	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (S)-MONOPHOS (185449-80-3) C ₂₂ H ₁₈ NO ₃ P; FW: 359.36; white xtl.; m.p. 190° <i>moisture sensitive</i> Note: Sold in collaboration with DSM for research purposes only. Patent no. WO02 04466. DSM's MonoPhos™ Ligand Kit component.	250mg 1g
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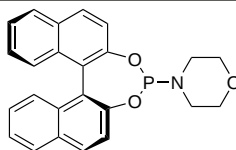
Technical Notes:

1. See 15-1232.
2. Asymmetric hydrogenation of ketones and β-keto esters.
3. Light-induced, enantioselective hydrogenation.

References:

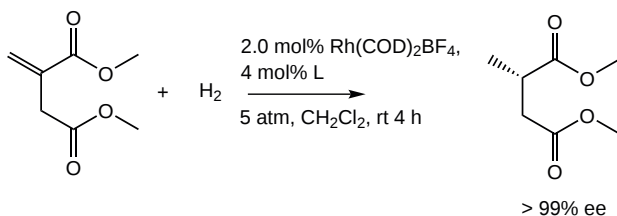
1. *Org. Lett.*, **2004**, 6, 4105.
2. *Angew. Chem. Int. Ed.*, **2004**, 43, 5066.
3. *J. Org. Chem.*, **2005**, 70, 943.
4. *Organometallics*, **2011**, 30, 3880.

15-1235	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)morpholine, min. 97% (S)-MorfPhos (185449-81-4) C ₂₄ H ₂₀ NO ₃ P; FW: 401.39; white powd. <i>moisture sensitive</i> Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.	100mg 500mg
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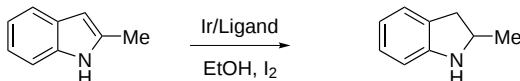


Technical Notes:

1. See 15-1232.
2. Ligand used in the enantioselective rhodium catalyzed low pressure high activity hydrogenation of α-dehydroaminoesters, enamides, and dimethylitaconate. See 15-1234.
3. Ligand used in iridium-catalyzed asymmetric hydrogenation of 2-methylindole



Tech. Note (2)
Ref. (1)

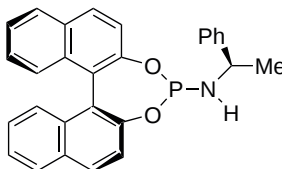


Tech. Note (3)
Ref. (2)

References:

1. *J. Org. Chem.*, **2005**, 70, 943.
2. *Tetrahedron Lett.*, **2014**, 55, 3613.

15-1525	(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)[(1R)-1-phenylethyl]amine, min. 95% (422509-53-3) C ₂₈ H ₂₂ NO ₃ P; FW: 435.45; white powd.; m.p. 212-213° <i>moisture sensitive</i> Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.	100mg 500mg
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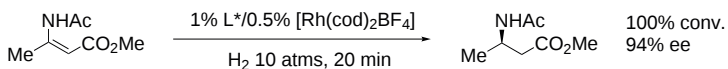


Technical Note:

1. The ligand for the rhodium-catalyzed enantioselective hydrogenation of (E)-N-acylated dehydro-β-aminoacid esters

PHOSPHORUS - Ligands and Compounds

15-1525 (continued) **(S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)((1R)-1-phenylethyl)amine, min. 95% (422509-53-3)**



100% conv.
94% ee

Tech. Note (1)
Ref. (1)

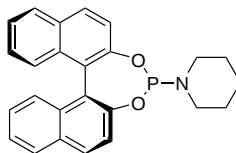
References:

1. *J. Am. Chem. Soc.*, **2002**, *124*, 14552

15-1234 (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)piperidine, min. 97% (S)-PipPhos (284472-79-3)

C₂₅H₂₂NO₂P; FW: 399.42; white powd.
moisture sensitive

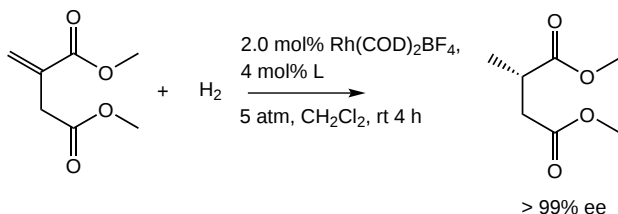
Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.



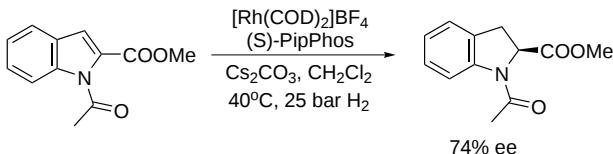
100mg
500mg
2g

Technical Notes:

1. See 15-1232.
2. Ligand used in the enantioselective rhodium catalyzed low pressure high activity hydrogenation of α-dehydroaminoesters, enamides, and dimethylitaconate.
3. Ligand used in asymmetric hydrogenation of 2-substituted N-protected indoles using Rhodium-based catalysts.



Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)

References:

1. *J. Org. Chem.*, **2005**, *70*, 943.
2. *Tetrahedron*, **2010**, *21*, 7.
3. *Organometallics*, **2011**, *30*, 1942.
4. *Adv. Synth. Catal.*, **2011**, 353.

15-1551 Diphenylchlorophosphine, min. 95% (1079-66-9)

HAZ (C₆H₅)₂PCl; FW: 220.64; yellow liq.; b.p. 100-102°/1mm; f.p. >230°F;
d. 1.19
air sensitive, moisture sensitive

50g
250g
1kg

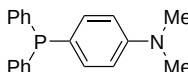
15-1549 Diphenylchlorophosphine, 98% (1079-66-9)

HAZ C₁₂H₁₀ClP; FW: 220.64; yellow liq.; b.p. 100-102°/1 mm; f.p. >230°F;
d. 1.19
moisture sensitive

25g
100g
500g

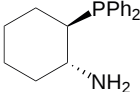
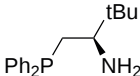
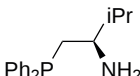
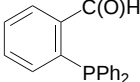
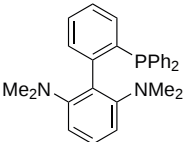
15-1380 Diphenyl[4-(N,N-dimethylamino)phenyl] phosphine, min. 95% (739-58-2)

NEW C₂₀H₂₀NP; FW: 305.35; white solid;
m.p. 151-154°
air sensitive



1g
5g

PHOSPHORUS - Ligands and Compounds

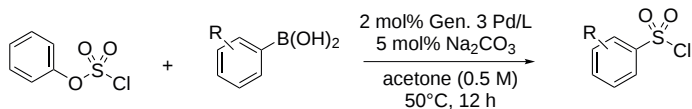
15-1700 amp HAZ 	Diphenylphosphine, 99% (829-85-6)	10g
	(C ₆ H ₅) ₂ PH; FW: 186.20; colorless liq.; b.p. 116-119°/2.6 mm; d. 1.07	50g
	pyrophoric	250g
15-1702 HAZ	Diphenylphosphine, 99% (10 wt% in hexanes) (829-85-6)	100g
	(C ₆ H ₅) ₂ PH; FW: 186.20; colorless liq.; d. 0.68	500g
	air sensitive	
15-1740 HAZ	Diphenylphosphinic chloride, 98% (1499-21-4)	5g
	(C ₆ H ₅) ₂ P(O)Cl; FW: 236.64; colorless to pale yellow liq.; b.p. 138-139°/0.15 mm; f.p. 79°F; d. 1.240	25g
	moisture sensitive	100g
15-7153	(1R,2R)-2-(Diphenylphosphino)-1-aminocyclohexane, min. 97% (452304-59-5)	100mg
	C ₁₈ H ₂₂ NP; FW: 283.35; white solid	500mg
	air sensitive	
		
15-7154	(1S,2S)-2-(Diphenylphosphino)-1-aminocyclohexane, min. 97% (452304-63-1)	100mg
	C ₁₈ H ₂₂ NP; FW: 283.35; white solid; m.p. 51-56°	500mg
	air sensitive	
15-7253 HAZ	(R)-1-(Diphenylphosphino)-2-amino-3-di-methylbutane, min. 97% (10wt% in hexanes) (1366384-12-4)	1g
	C ₁₈ H ₂₄ NP; FW: 285.36; colorless liq.	5g
	air sensitive	
		
15-7255 HAZ	(S)-1-(Diphenylphosphino)-2-amino-3,3-dimethylbutane, min. 97% (10wt% in hexanes) (286454-86-2)	1g
	C ₁₈ H ₂₄ NP; FW: 285.36; colorless liq.	5g
	air sensitive	
15-7146	(R)-1-(Diphenylphosphino)-2-amino-3-methylbutane, min. 97% (1400149-69-0)	100mg
	C ₁₇ H ₂₂ NP; FW: 271.34; colorless oil	500mg
	air sensitive	
		
15-7147	(S)-1-(Diphenylphosphino)-2-amino-3-methylbutane, min. 97% (146476-37-1)	100mg
	C ₁₇ H ₂₂ NP; FW: 271.34; colorless oil	500mg
	air sensitive	
15-0120	2-(Diphenylphosphino)benzaldehyde, min. 97% (50777-76-9)	250mg
	(C ₆ H ₅) ₂ P(C ₆ H ₅ COH); FW: 290.30; white to yellow powdr.; m.p. 112-115°	1g
		
15-0133	2-(Diphenylphosphino)benzoic acid, min. 97% (17261-28-8)	1g
	(C ₆ H ₅) ₂ P(C ₆ H ₅ COOH); FW: 306.30; white to yellow solid; m.p. 174-181°	5g
15-1125 NEW	2-Diphenylphosphino-2',6'-bis(dimethyl-amino)-1,1'-biphenyl, min. 98% PhCPhos (1447963-71-4)	100mg
	C ₂₈ H ₂₈ N ₂ P; FW: 424.52; tan solid	500mg
	Note: Patents: US 6,395,916, US 6,307,087	
		

Technical Notes:

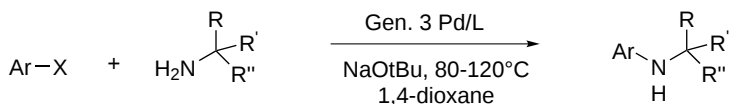
- Ligand for the Palladium catalyzed chlorosulfonylation of aryl boronic acids
- Ligand for the Palladium-catalyzed Buchwald-Hartwig cross-coupling of hindered primary amines and aryl halides

PHOSPHORUS - Ligands and Compounds

15-1125 **2-Diphenylphosphino-2',6'-bis(dimethylamino)-1,1'-biphenyl**, min. 98% PhCPhos
(continued) (1447963-71-4)



Tech. Note (1)
Ref. (1)

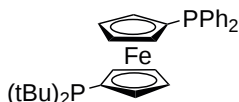


Tech. Note (2)
Ref. (2)

References:

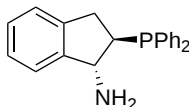
1. J. Am. Chem. Soc., **2013**, 135, 10638
2. J. Am. Chem. Soc., **2015**, 137, 3085

26-1240 **1-Diphenylphosphino-1'-(di-*t*-butylphosphino)ferrocene**, 97%
(95408-38-1)
C₃₀H₃₆FeP₂; FW: 514.40; yellow to orange powdr.; m.p. 75-79°
air sensitive



250mg
1g

15-1110 **(1*R*,2*R*)-2-(Diphenylphosphino)-2,3-dihydro-1*H*-inden-1-amine**, min. 97%
HAZ (10wt% in THF) (1091606-70-0)
C₂₁H₂₀NP; FW: 317.36; colorless to pale yellow liq.
air sensitive



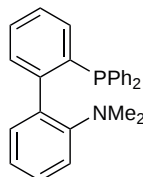
1g
5g

Note: Sold under license from Kanata for research purposes only. WO2008148202.

15-1111 **(1*S*,2*S*)-2-(Diphenylphosphino)-2,3-dihydro-1*H*-inden-1-amine**, min. 97% (10wt% in THF) (1091606-69-7)
HAZ C₂₁H₂₀NP; FW: 317.36; colorless to pale yellow liq.
air sensitive
Note: Sold under license from Kanata for research purposes only. WO2008148202.

1g
5g

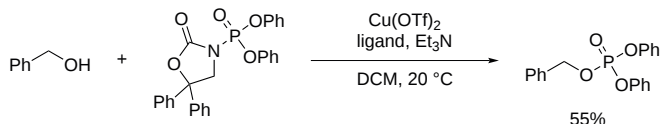
15-1745 **2-Diphenylphosphino-2'-(*N,N*-dimethylamino))-1,1'-biphenyl**, 98% PhDavePhos (240417-00-9)
C₂₆H₂₄NP; FW: 381.46; white powdr.
Note: Buchwald Biaryl Phosphine Ligand Master Kit component.. Buchwald Biaryl Phosphine Ligand Mini Kit 2 component.. Patents: US 6,395,916, US 6,307,087.



500mg
2g
10g

Technical Notes:

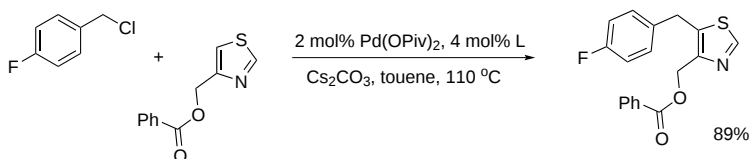
1. Useful ligand for sterically hindered substrates in the Pd-catalyzed amination reactions of aryl bromides.
2. Ligand used for the Cu-catalyzed phosphorylation of alcohols
3. Ligand for Pd-catalyzed C-H benzylation
4. Ligand for palladium-catalyzed [4 + 2] benzannulation reaction.



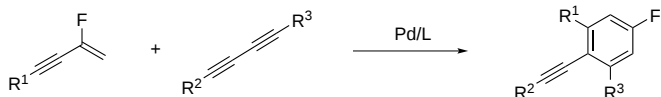
Tech. Note (2)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-1745 **2-Diphenylphosphino-2'-(N,N-dimethylamino))-1,1'-biphenyl, 98% PhDavePhos**
(continued) (240417-00-9)



Tech. Note (3)
Ref. (2)

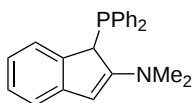


Tech. Note (4)
Ref. (3)

References:

1. *Org. Lett.*, **2005**, 7, 3271.
2. *Org. Lett.*, **2009**, 11, 4160.
3. *Org. Lett.*, **2013**, 15, 2562.
4. *Chem. Sci.*, **2011**, 2, 27.

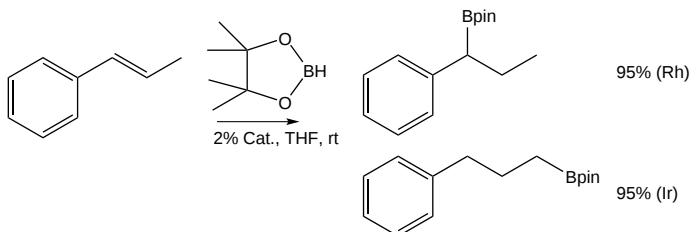
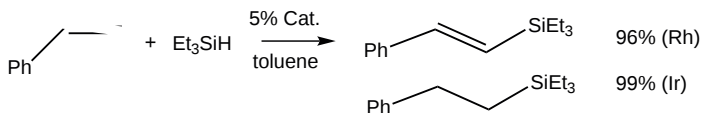
15-1748 **1-Diphenylphosphino-2-(N,N-dimethylamino)-1H-indene, 99% (contains vinylic isomer) (628323-64-8)**
 $C_{23}H_{22}NP$; FW: 343.40; off-white xtl.
(store cold)



250mg
1g

Technical Note:

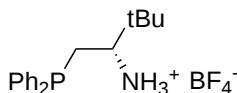
1. Zwitterionic hydrogenation, hydrosilylation and hydroboration catalyst soluble in non-polar solvents.



References:

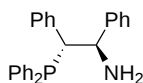
1. *Organometallics*, **2007**, 26, 594.
2. *Organometallics*, **2006**, 25, 5965.

15-7194 **(S)-1-(Diphenylphosphino)-3,3-dimethylbutan-2-aminium tetrafluoroborate, min. 97%**
 $C_{18}H_{25}BF_4NP$; FW: 373.18; white solid
air sensitive
Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.



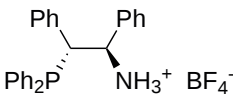
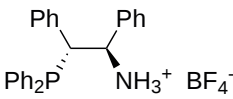
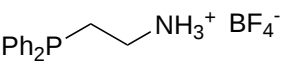
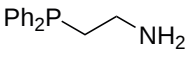
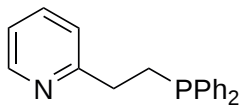
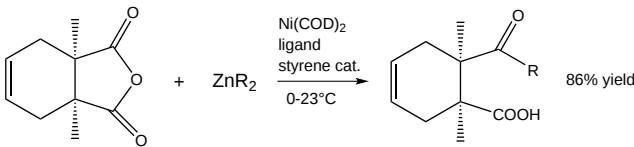
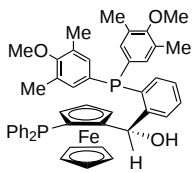
100mg
500mg

15-7102 **(1R,2R)-2-(Diphenylphosphino)-1,2-diphenylethylamine, min. 97% (1091606-68-6)**
 $C_{26}H_{24}NP$; FW: 318.45; white solid
air sensitive
Note: Sold under license from Kanata for research purposes only. WO2008148202.

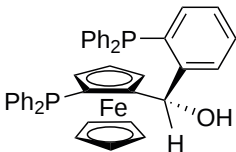
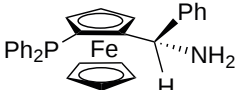
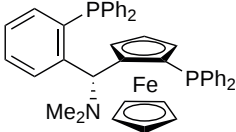


100mg
500mg

PHOSPHORUS - Ligands and Compounds

15-7103	(1S,2S)-2-(Diphenylphosphino)-1,2-diphenylethylamine, min. 97% (1091606-67-5) $C_{26}H_{24}NP$; FW: 318.45; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. WO2008148202.		100mg 500mg
15-7156	(1R,2R)-2-(Diphenylphosphino)-1,2-diphenylethylammonium tetrafluoroborate, min. 97% $C_{26}H_{25}BF_4NP$; FW: 469.26; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.		100mg 500mg
15-7174	2-(Diphenylphosphino)ethanammium tetrafluoroborate, min. 97% (1222630-32-1) $C_{14}H_{17}BF_4NP$; FW: 317.06; white to beige solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.		500mg 2g
15-1762	2-(Diphenylphosphino)ethylamine, min. 95% (4848-43-5) $(C_6H_5)_2PCH_2CH_2NH_2$; FW: 229.26; colorless to yellow liq. <i>air sensitive</i>		1g 5g
Technical Note: 1. Ligand used in the preparation of a highly efficient ruthenium catalyst for the chemoselective hydrogenolysis of epoxides.			
References: 1. <i>Organometallics</i> , 2003 , 22, 4190.			
15-1765	2-[2-(Diphenylphosphino)ethyl]pyridine, min. 97% (10150-27-3) $C_{19}H_{18}NP$; FW: 291.33; white powdr. <i>air sensitive</i>		100mg 500mg
Technical Note: 1. Catalyst used for the room temperature cross-coupling of organozinc reagents with carboxylic fluorides, chlorides, anhydrides and thioesters.			
			
References: 1. <i>Org. Lett.</i> , 2006 , 8, 4307. 2. <i>J. Am. Chem. Soc.</i> , 2004 , 126, 15964.			
26-1153	(S)-(-)-[(S)-2-Diphenylphosphinoferrocenyl][2-bis(3,5-dimethyl-4-methoxyphenyl)phosphinophenyl]methanol, min. 97% (851308-47-9) $C_{47}H_{47}FeO_2P_2$; FW: 777.68; orange foam Note: Air-stable. Sold in collaboration with Solvias for research purposes only.		100mg

PHOSPHORUS - Ligands and Compounds

26-1160	(S)-(-)-[(S)-2-Diphenylphosphinoferrocenyl][2-diphenylphosphinophenyl]methanol, min. 97% (851308-43-5) C ₄₁ H ₃₄ FeOP ₂ ; FW: 660.50; yellow powdr. Note: Air-stable. Sold in collaboration with Solvias for research purposes only.		100mg 500mg
26-1151	(R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]benzylamine, min. 98% (498580-48-6) C ₂₉ H ₂₆ FeNP; FW: 475.34; yellow to orange powdr.		100mg 500mg
26-1152	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]benzylamine, min. 98% C ₂₉ H ₂₆ FeNP; FW: 475.34; yellow to orange powdr.		100mg 500mg
26-1156	(R)-(+)-[(R)-2-Diphenylphosphinoferrocenyl](N,N-dimethylamino)(2-diphenylphosphinophenyl)methane, min. 97% (1003012-96-1) C ₄₃ H ₃₉ FeNP ₂ ; FW: 687.57; orange powdr. (store cold) Note: Sold in collaboration with Solvias for research purposes only.		100mg 500mg 2g 10g

Technical Note:

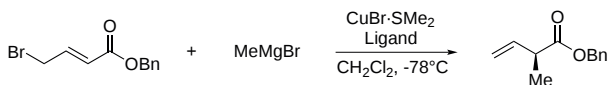
1. Precursor ligand for the preparation of catalysts used in palladium-catalyzed asymmetric allylic alkylations.

Technical Note:

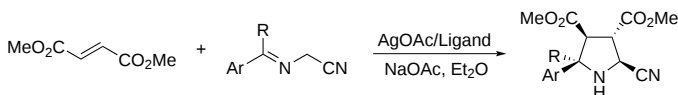
1. See 26-1151 (page 213)

Technical Notes:

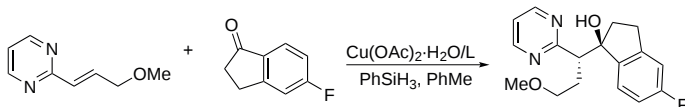
1. Ligand for copper-catalyzed asymmetric allylic alkylation of halocrotonates.
2. Ligand for silver-catalyzed asymmetric 1,3-dipolar cycloadditions of α -iminonitriles.
3. Ligand for copper-catalyzed enantioselective reductive couplings of alkenylazaarenes with ketones.
4. Ligand for copper-catalyzed chiral Mannich-type reactions of γ -butenolides and N-thiophosphinoyl ketimines.
5. Ligand for palladium-catalyzed asymmetric borylation.
6. Ligand for copper-catalyzed enantiodivergent hydroboration of bicyclic alkenes.



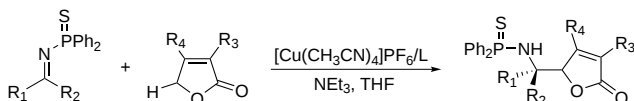
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



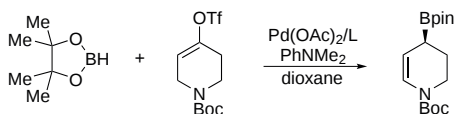
Tech. Note (3)
Ref. (3)



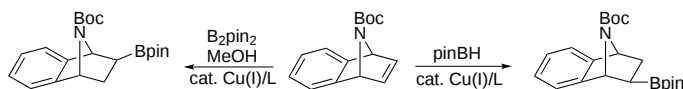
Tech. Note (4)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

26-1156 (continued) (R)-(+)-[(R)-2-Diphenylphosphinoferrocenyl](N,N-dimethylamino)(2-diphenylphosphino-phenyl)methane, min. 97% (1003012-96-1)



Tech. Note (5)
Ref. (5)

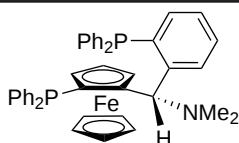


Tech. Note (6)
Ref. (6)

References:

1. *Adv. Synth. Catal.*, **2010**, 352, 999.
2. *Chem. Commun.*, **2011**, 47, 6784.
3. *J. Am. Chem. Soc.*, **2012**, 134, 8428.
4. *Angew. Chem. Int. Ed.*, **2013**, 52, 7310.
5. *Angew. Chem. Int. Ed.*, **2013**, 52, 8069.
6. *Org. Lett.*, **2015**, 17, 764.

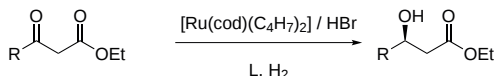
26-1155 (S)-(-)-[(S)-2-Diphenylphosphinoferrocenyl] (N,N-dimethylamino) (2-diphenylphosphinophenyl) methane, min. 97% TANIAPHOS (850444-36-9)
C₄₃H₃₉FeNP₂; FW: 687.57; orange powdr.
(store cold)
Note: Sold in collaboration with Solvias for research purposes only.



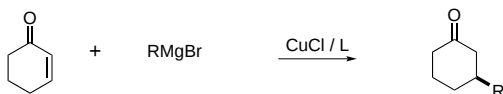
100mg
500mg
2g
10g

Technical Notes:

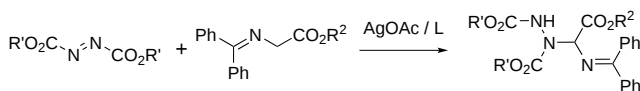
1. Ligand for the Ru-catalyzed hydrogenation of β -ketoesters, enamides and itaconates.
2. Ligand for Cu-catalyzed asymmetric conjugate addition of Grignard reagents to cyclic enones.
3. AgOAc-catalyzed asymmetric amination of glycine Schiff bases with azodicarboxylates.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

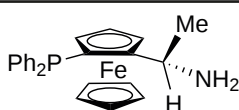


Tech. Note (3)
Ref. (4)

References:

1. *Angew. Chem. Int. Ed.*, **1999**, 38, 3212
2. *Proc. Nat. Acad. Sci.*, **2004**, 10, 5834
3. *Tetrahedron Asymm.*, **2004**, 15, 2299
4. *Tetrahedron Lett.*, **2009**, 50, 6866

26-1425 (R)-1-((S)-2-Diphenylphosphinoferrocenylethylamine, min. 97% (607389-84-4)
C₂₄H₂₄FeNP; FW: 413.27; yellow solid
air sensitive



100mg
500mg

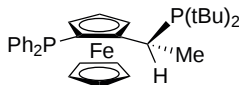
26-1426 (S)-1-((R)-2-Diphenylphosphinoferrocenylethylamine, min. 97%
C₂₄H₂₄FeNP; FW: 413.27; yellow solid
air sensitive

100mg
500mg

PHOSPHORUS - Ligands and Compounds

26-1200

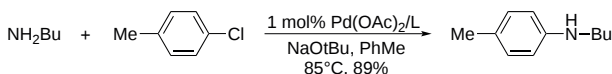
(R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethylidene-*t*-butylphosphine, min. 97% (155830-69-6)
 $C_{32}H_{40}FeP_2$; FW: 542.46; orange pwdr.
 Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.



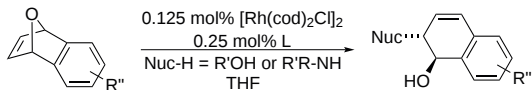
100mg
 500mg
 2g
 10g

Technical Notes:

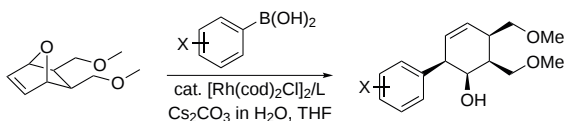
1. Ligand for Palladium-catalyzed amination of aryl halides.
2. Ligand for Rhodium-catalyzed asymmetric alcoholysis and aminolysis of oxabenzonorbornadiene.
3. Ligand for Rhodium-catalyzed asymmetric ring opening of oxabicyclic alkenes with organoboronic acids.
4. Ligand for Copper-catalyzed asymmetric 1,4-hydrosilylations of α,β -unsaturated esters.
5. Ligand for Ruthenium-catalyzed asymmetric hydrogenation of N-sulfonated- α -dehydroamino acids.
6. Ligand for Rhodium-catalyzed asymmetric hydrogenation of enamines.
7. Ligand for Palladium-catalyzed Kumada coupling of aryl and vinyl tosylates.
8. Ligand for Palladium-catalyzed enantioselective synthesis of aryl sulfoxides.
9. Ligand for Rhodium-catalyzed enantioselective insertion of a carbenoid carbon into a C-C bond.



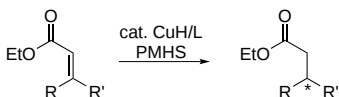
Tech. Note (1)
 Ref. (1,13)



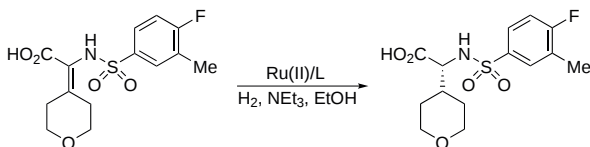
Tech. Note (2)
 Ref. (2,3,5,14,16)



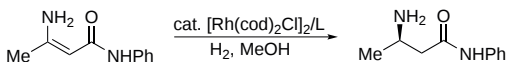
Tech. Note (3)
 Ref. (4,17)



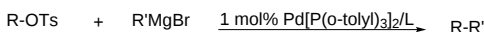
Tech. Note (4)
 Ref. (6,10)



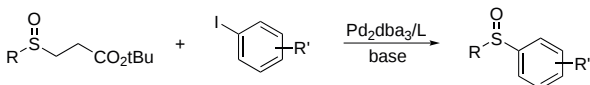
Tech. Note (5)
 Ref. (7)



Tech. Note (6)
 Ref. (8,11,15)



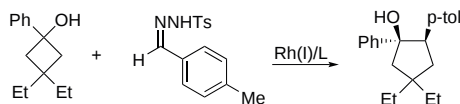
Tech. Note (7)
 Ref. (9)



Tech. Note (8)
 Ref. (12)

PHOSPHORUS - Ligands and Compounds

26-1200 (R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethyl-di-t-butylphosphine, min. 97%
(continued) (155830-69-6)



Tech. Note (9)
Ref. (18)

References:

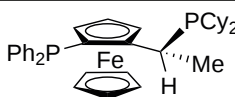
1. *J. Am. Chem. Soc.*, **1998**, *120*, 7369.
2. *J. Am. Chem. Soc.*, **2000**, *122*, 5650.
3. *Org. Lett.*, **2000**, *2*, 1677.
4. *Org. Lett.*, **2002**, *4*, 1311.
5. *J. Am. Chem. Soc.*, **2003**, *125*, 14884.
6. *J. Am. Chem. Soc.*, **2004**, *126*, 8352.
7. *Org. Lett.*, **2005**, *7*, 3405.
8. *Org. Lett.*, **2005**, *7*, 4935.
9. *J. Org. Chem.*, **2005**, *70*, 9364.
10. *Org. Lett.*, **2006**, *8*, 1963.
11. *Org. Process Res. Dev.*, **2006**, *10*, 723.
12. *Org. Lett.*, **2007**, *9*, 5493.
13. *J. Am. Chem. Soc.*, **2008**, *130*, 6586.
14. *J. Am. Chem. Soc.*, **2009**, *131*, 444.
15. *J. Am. Chem. Soc.*, **2009**, *131*, 8798.
16. *Org. Lett.*, **2010**, *12*, 5418.
17. *Org. Lett.*, **2013**, *15*, 3424.
18. *J. Am. Chem. Soc.*, **2014**, *136*, 7217.

26-1201	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethyl-di-t-butylphosphine, min. 97% (277306-29-3) C ₃₂ H ₄₀ FeP ₂ ; FW: 542.46; orange powdr. Note: Sold in collaboration with Solvias for research purposes only.	100mg 500mg 2g 10g
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Technical Note:

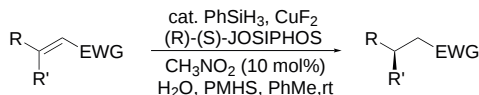
1. See 26-1200 (page 215)

26-1210	(R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethyl-dicyclohexylphosphine ethanol adduct, min. 97% (R)-(S)-JOSIPHOS (155806-35-2) C ₃₆ H ₄₄ FeP ₂ ·CH ₃ CH ₂ OH; FW: 594.59 (640.66); orange powdr. (store cold) Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.	100mg 500mg 2g 10g
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Technical Notes:

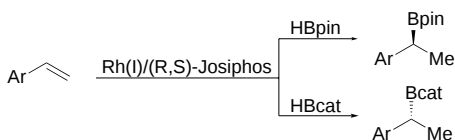
1. Ligand for Copper-catalyzed enantioselective reduction of alkenes bearing electron-withdrawing groups.
2. Ligand for Rhodium-catalyzed regio- and enantiocontrol in the hydroboration of vinyl arenes with pinacol borane.
3. Ligand for Palladium-catalyzed enantioselective desymmetrization of meso-succinic anhydride.
4. Ligand for Copper-catalyzed enantioselective conjugate addition of Grignard reagents to acyclic enones.
5. Ligand for Copper-catalyzed enantioselective reduction of 2-alkenylheteroarenes.
6. Ligand for Copper-catalyzed conjugate addition of trialkylaluminum reagents to extended nitro-Michael acceptors.
7. Ligand for Rhodium-catalyzed enantioselective hydrogenation of o-alkoxy tetrasubstituted enamides.



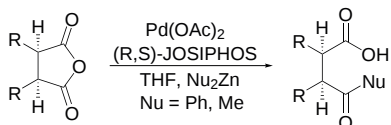
Tech. Note (1)
Ref. (1, 6, 7)

PHOSPHORUS - Ligands and Compounds

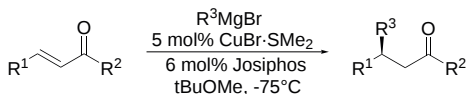
26-1210 (R)-(-)-1-[(S)-2-(Diphenylphosphino) ferrocenyl]ethylidicyclohexylphosphine ethanol
(continued) adduct, min. 97% (R)-(S)-JOSIPHOS (155806-35-2)



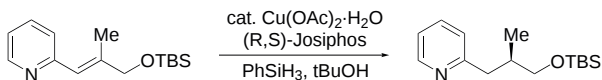
Tech. Note (2)
Ref. (2)



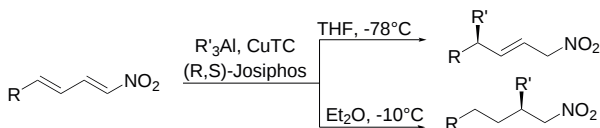
Tech. Note (3)
Ref. (3)



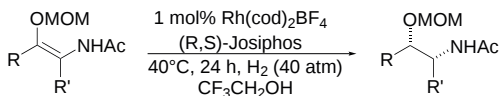
Tech. Note (4)
Ref. (4, 5)



Tech. Note (5)
Ref. (8)



Tech. Note (6)
Ref. (9)



Tech. Note (7)
Ref. (10)

References:

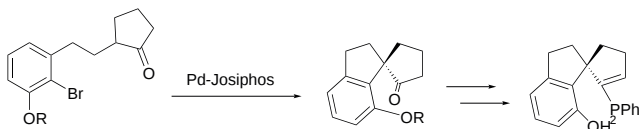
1. *Org. Lett.*, **2004**, 6, 4575.
2. *J. Am. Chem. Soc.*, **2004**, 126, 9200.
3. *J. Am. Chem. Soc.*, **2004**, 126, 10248.
4. *J. Am. Chem. Soc.*, **2004**, 126, 12784.
5. *J. Am. Chem. Soc.*, **2005**, 127, 9966.
6. *Org. Process Res. Dev.*, **2007**, 11, 633.
7. *Org. Lett.*, **2007**, 9, 2749.
8. *J. Am. Chem. Soc.*, **2009**, 131, 10386.
9. *Org. Lett.*, **2010**, 12, 2770.

PHOSPHORUS - Ligands and Compounds

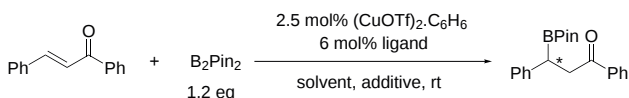
26-1211	(S)-(+)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethylidicyclohexylphosphine ethanol adduct, min. 97% (S)-(R)-JOSIPHOS	100mg
	(162291-02-3)	500mg
	C ₃₆ H ₄₄ FeP ₂ ·CH ₃ CH ₂ OH; FW: 594.59 (640.66); orange pwdr.	2g
	(store cold)	10g
Note: Sold in collaboration with Solvias for research purposes only.		

Technical Notes:

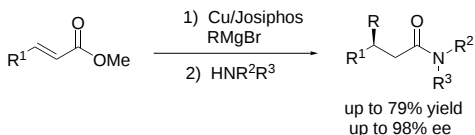
1. Ferrocenylphosphine ligands of the type cpFecp(PR₂)(*CH(CH₃)PR'₂) are a class of asymmetric ligands developed at Solvias in Basel, Switzerland.¹ Ligands of this type are currently used industrially in the stereoselective synthesis of commercial products.^{2,3} A unique feature of these bidentate ligands is the presence of a fixed phosphine moiety and a stereogenic, functionalized side chain, which can be easily modified to accommodate electronic and steric requirements. Based on a versatile synthetic procedure starting with optically active ferrocenes of the type cpFecp(PR₂)(*CH(CH₃)X) [X = OAc or NR₁], a variety of donor atoms can be introduced into the side chain⁴. These ferrocene based phosphine ligands have wide application in the stereoselective hydrogenation of substituted acetamidoacrylates, enol acetates, β-ketoesters and simple alkenes.⁵⁻⁹
2. Pd-catalyzed, enantioselective, intramolecular α-substituted cyclic ketones: facile synthesis of functionalized chiral spirobicycles.
3. Asymmetric boron conjugate addition of α,β-unsaturated carbonyl compounds catalyzed by CuOTf/Josiphos under non-alkaline conditions.
4. Chiral amides via copper-catalyzed enantioselective conjugate addition.
5. Ruthenium-catalyzed enantioselective synthesis of β-amino alcohols from 1,2-diols by "borrowing hydrogen".
6. Cobalt-catalyzed asymmetric addition of silylacetylenes to 1,1-disubstituted allenes.



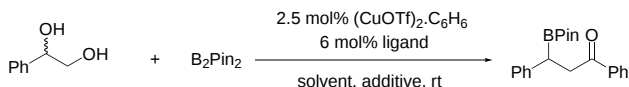
Tech. Note (1)
Ref. (2)



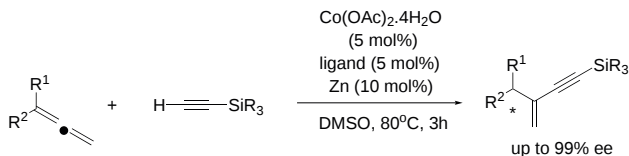
Tech. Note (2)
Ref. (3)



Tech. Note (3)
Ref. (4)



Tech. Note (4)
Ref. (5)



Tech. Note (5)
Ref. (6)

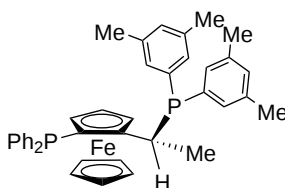
References:

1. Solvias owns the patent rights for Strem products 26-1000, 26-1001, 26-1200, 26-1201, 26-1230, 26-1101, and for the Ir and Rh complexes of the aforementioned products, including the complexes of 26-1210 and 26-1211.
2. *Org. Biomol. Chem* **2015**, 13,4837.
3. *Org. Chem. Front.*, **2015**, 2, 42.
4. *Org. Biomol. Chem.*, **2014**, 12, 36.
5. *Eur. J. Org. Chem.*, **2013**, 27, 6146.
6. *J. Org. Chem.*, **2013**, 78, 8986.

PHOSPHORUS - Ligands and Compounds

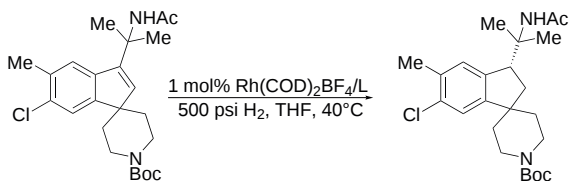
26-1255 (R)-(-)-1-[(S)-2-(Diphenylphosphino)ferrocenyl]ethylidene-3,5-xylylphosphine, min. 97%
(184095-69-0)
 $C_{40}H_{40}FeP_2$; FW: 638.56; orange powdr.
Note: Sold in collaboration with Solvias for research purposes only. Solvias Josiphos Ligand Kit component.

100mg
500mg
2g
10g



Technical Note:

- Ligand for Rhodium-catalyzed asymmetric hydrogenation in the synthesis of tertiary carbinamide.



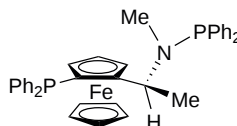
Tech. Note (1)
Ref. (1)

References:

- J. Org. Chem.*, **2008**, 73, 1639.

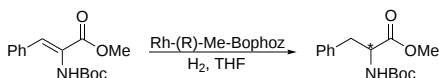
26-2515 (R)-1-[(S)-2-Diphenylphosphinoferrocenyl](N-methyl)(N-diphenylphosphino)ethylamine (R)-Me-Bophoz
(406680-94-2)
 $C_{37}H_{35}FeNP_2$; FW: 611.50; yellow solid
Note: Sold in collaboration with JM for research purposes only.

100mg
500mg

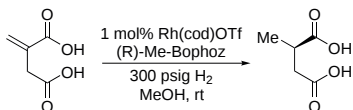


Technical Notes:

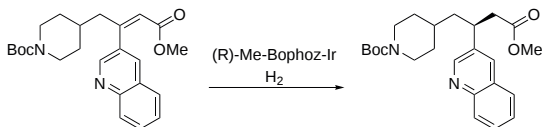
- Ligand for Rhodium-catalyzed asymmetric hydrogenation of dehydro- α -amino acid derivatives.
- Ligand for Rhodium-catalyzed asymmetric hydrogenation of itaconate derivatives.
- Ligand for Iridium-catalyzed asymmetric hydrogenation in the synthesis of an α,β integrin antagonist intermediate.
- Ligand for Rhodium-catalyzed asymmetric hydrogenation of β -amino-vinylphosphonates to β -aminophosphonates



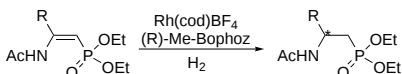
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

References:

- Org. Lett.*, **2002**, 4, 2421.
- J. Org. Chem.*, **2005**, 70, 1872.
- Tetrahedron: Asymmetry*, **2008**, 938.
- Tetrahedron: Asymmetry*, **2008**, 1189.

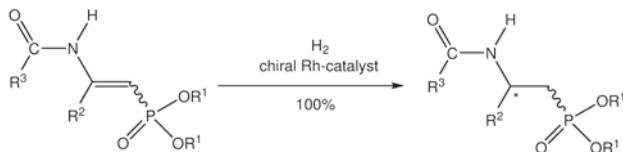
PHOSPHORUS - Ligands and Compounds

26-2516 (S)-1-[(R)-2-Diphenylphosphinoferrocenyl](N-methyl)(N-diphenylphosphino)ethylamine (S)-Me-Bophoz (406681-09-2)
 $C_{37}H_{35}FeNP_2$; FW: 611.50; yellow solid
 Note: Sold in collaboration with JM for research purposes only.

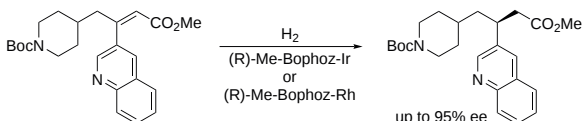
100mg
 500mg

Technical Notes:

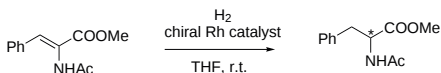
- Ligand used in the rhodium-catalyzed, asymmetric hydrogenation of β -amido-vinylphosphonates.
- Ligand used in the rhodium or iridium-catalyzed asymmetric hydrogenation of α,β -unsaturated esters.



Tech. Note (1)
 Ref. (1)



Tech. Note (2)
 Ref. (2)

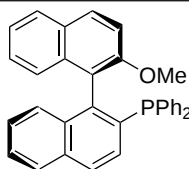


Tech. Note (3)
 Ref. (3)

References:

- Tetrahedron Asymm.*, **2008**, *19*, 1189.
- Tetrahedron Asymm.*, **2008**, *19*, 938.
- J. Org. Chem.* **2005**, *70*, 1872.

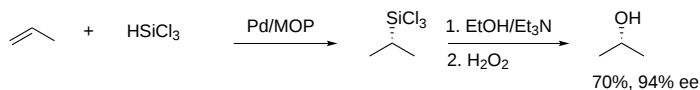
15-1775 (R)-(+)-2-(Diphenylphosphino)-2'-methoxy-1,1'-binaphthyl, 99% (R)-MOP (145964-33-6)
 $C_{33}H_{25}OP$; FW: 468.53; white powdr.;
 m.p. 177-179°
air sensitive
 Note: Sold in collaboration with Takasago for research purposes only. Patents US 5231202, EP 0503884, JP 05-017491.



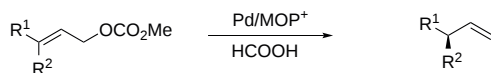
100mg
 500mg

Technical Notes:

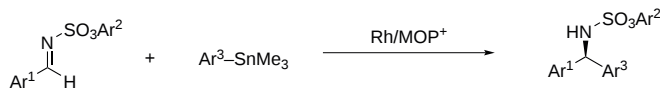
- Efficient catalyst for the enantioselective hydrosilylation of 1-alkenes to optically active 2-alcohols.
- Ligand for palladium-catalyzed asymmetric reduction of allylic esters.
- Ligand for the rhodium-catalyzed asymmetric arylation of imines with organostannanes.
- Ligand for the rhodium-catalyzed asymmetric addition of aryl- and alkenylboronic acids to Isatins.
- Ligand for desymmetrization of malonamides via an enantioselective intramolecular Buchwald-Hartwig reaction.



Tech. Note (1)
 Ref. (1,2)



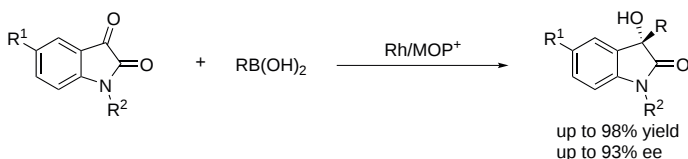
Tech. Note (2)
 Ref. (3)



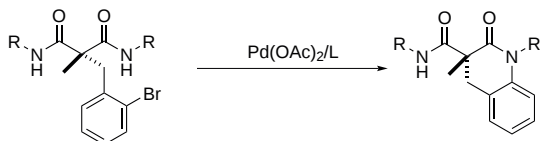
Tech. Note (3)
 Ref. (4)

PHOSPHORUS - Ligands and Compounds

15-1775 (R)-(+)-2-(Diphenylphosphino)-2'-methoxy-1,1'-binaphthyl, 99% (R)-MOP (145964-33-6)
(continued)



Tech. Note (4)
Ref. (5)



Tech. Note (5)
Ref. (6)

References:

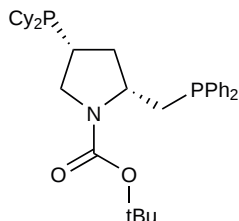
1. *J. Am. Chem. Soc.*, **1991**, 113, 9887.
2. *Acc. Chem. Res.*, **2000**, 33, 354. (review)
3. *J. Am. Chem. Soc.*, **1994**, 116, 775.
4. *J. Am. Chem. Soc.*, **2000**, 122, 976.
5. *Angew. Chem. Int. Ed.*, **2006**, 45, 3353.
6. *Tetrahedron Lett.*, **2009**, 50, 4170

15-1776	(S)-(-)-2-(Diphenylphosphino)-2'-methoxy-1,1'-binaphthyl, 99% (S)-MOP (134484-36-9)	100mg 500mg
	C ₃₃ H ₂₅ OP; FW: 468.53; white powdr.; m.p. 175-179° air sensitive Note: Sold in collaboration with Takasago for research purposes only. Patents US 5231202, EP 0503884, JP 05-017491.	

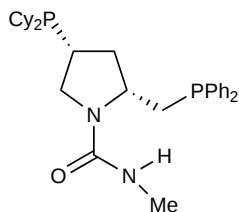
Technical Note:

1. See 15-1775 (page 220)

15-7220	(2R,4R)-(+)-2-(Diphenylphosphinomethyl)-4-(dicyclohexylphosphino)-N-(t-butoxycarbonyl)pyrrolidine, min. 97% (R,R-BCPM) (114751-47-2)	50mg 250mg
	C ₃₄ H ₄₉ NO ₂ P ₂ ; FW: 565.71; white powdr. air sensitive	

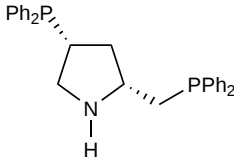
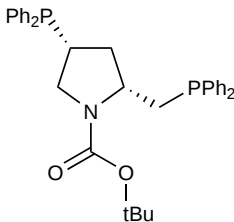
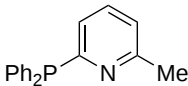
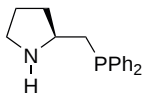
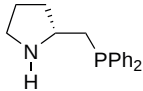
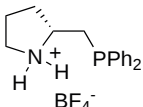
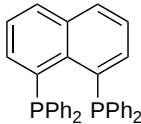


15-7224	(2R,4R)-(+)-2-(Diphenylphosphinomethyl)-4-(dicyclohexylphosphino)-N-methyl-1-pyrrolidinecarboxamide, min. 95% (R,R-MCCPM) (122709-72-2)	50mg 250mg
	C ₃₁ H ₄₄ N ₂ OP ₂ ; FW: 522.64; white powdr. air sensitive	



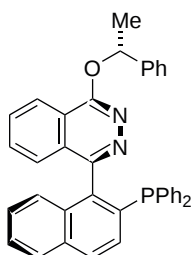
15-7225	(2S,4S)-(-)-2-(Diphenylphosphinomethyl)-4-(dicyclohexylphosphino)-N-methyl-1-pyrrolidinecarboxamide, min. 97% (S,S-MCCPM) (112521-97-8)	50mg 250mg
	C ₃₁ H ₄₄ N ₂ OP ₂ ; FW: 522.64; white powdr. air sensitive	

PHOSPHORUS - Ligands and Compounds

15-7210	(2R,4R)-(+)-2-(Diphenylphosphinomethyl)-4-(diphenylphosphino)pyrrolidine, min. 97% (R,R-PPM) (77450-05-6) $C_{29}H_{29}NP_2$; FW: 453.50; white powdr. <i>air sensitive</i>		100mg 500mg
15-7211	(2S,4S)-(-)-2-(Diphenylphosphinomethyl)-4-(diphenylphosphino)pyrrolidine, min. 97% (S,S-PPM) (61478-29-3) $C_{29}H_{29}NP_2$; FW: 453.50; white powdr. <i>air sensitive</i>		100mg 500mg
15-7216	(2R,4R)-(+)-2-(Diphenylphosphinomethyl)-4-(diphenylphosphino)-N-(t-butoxycarbonyl)pyrrolidine, min. 97% (R,R-BPPM) (72598-03-9) $C_{34}H_{37}NO_2P_2$; FW: 553.61; white powdr. <i>air sensitive</i>		100mg 500mg
15-7217	(2S,4S)-(-)-2-(Diphenylphosphinomethyl)-4-(diphenylphosphino)-N-(t-butoxycarbonyl)pyrrolidine, min. 97% (S,S-BPPM) (61478-28-2) $C_{34}H_{39}NO_2P_2$; FW: 565.71; white powdr. <i>air sensitive</i>		100mg 500mg
15-1804	2-Diphenylphosphino-6-methylpyridine, 98% (132682-77-0) $C_{16}H_{16}NP$; FW: 277.30; white to off-white xtl.; m.p. 81-83°		500mg 2g
15-7116	(S)-2-[(Diphenylphosphino)methyl]pyrrolidine, min. 97% (60261-46-3) $C_{17}H_{20}NP$; FW: 269.32; colorless to pale yellow liq. <i>air sensitive</i>		250mg 1g
15-7115 HAZ	(R)-2-[(Diphenylphosphino)methyl]pyrrolidine, min. 97% (10 wt% in tetrahydrofuran) (428514-91-4) $C_{17}H_{20}NP$; FW: 269.32; colorless liq. <i>air sensitive</i>		2g 10g
15-7165	(R)-2-[(Diphenylphosphino)methyl]pyrrolidinium tetrafluoroborate, min. 97% (1222630-36-5) $C_{17}H_{21}BF_4NP$; FW: 357.13; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.		100mg 500mg
15-7166	(S)-2-[(Diphenylphosphino)methyl]pyrrolidinium tetrafluoroborate, min. 97% (1222630-36-5) $C_{17}H_{21}BF_4NP$; FW: 357.13; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.		100mg 500mg
15-7123	1,8-(Diphenylphosphino)naphthalene, 99% (153725-04-3) $C_{34}H_{26}P_2$; FW: 496.52; yellow xtl. <i>air sensitive</i>		250mg 1g

PHOSPHORUS - Ligands and Compounds

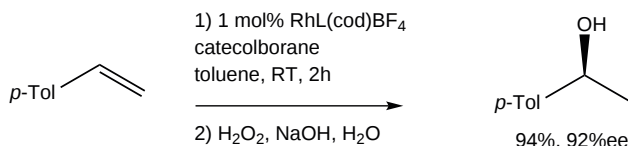
15-1782 (R)-(+)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethoxy]phthalazine, min. 97% (R,R)-O-PINAP (828927-95-3)
 $C_{38}H_{29}N_2OP$; FW: 560.62; colorless xtl.; m.p. 64-65°
air sensitive
 Note: PINAP Ligand Kit component.



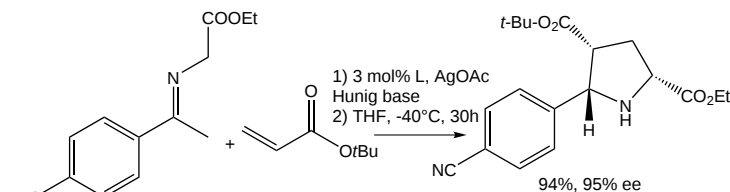
250mg
1g

Technical Notes:

1. The PINAP family of P,N ligands is a synthetically more accessible but a similarly performing analog of the QUINAP (15-1777, 15-1778) ligand in enantioselective hydroboration, alkyne addition, and azomethine cycloaddition reactions. (Ref. 1)
2. With rhodium, enantioselective hydroboration of alkenes as a route to chiral alcohols.
3. With silver, catalytic, enantioselective, azomethine cycloaddition with acrylates.



Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (1)

References:

1. *Angew. Chem. Int. Ed.*, **2004**, 43, 5971.

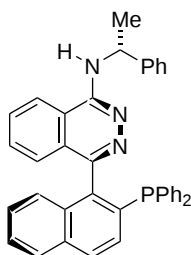
15-1783 (S)-(-)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethoxy]phthalazine, min. 97% (R,S)-O-PINAP (828927-94-2)
 $C_{38}H_{29}N_2OP$; FW: 560.62; colorless xtl.; m.p. 178-181°
air sensitive
 Note: PINAP Ligand Kit component.

250mg
1g

Technical Note:

1. See 15-1782 (page 223)

15-1784 (R)-(+)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethyl]-1-phthalazinamine, min. 97% (R,R)-N-PINAP (828927-97-5)
 $C_{38}H_{30}N_3P$; FW: 559.64; colorless xtl.; m.p. 185-188°
air sensitive
 Note: PINAP Ligand Kit component.



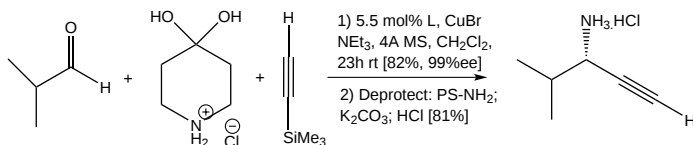
100mg
500mg

Technical Notes:

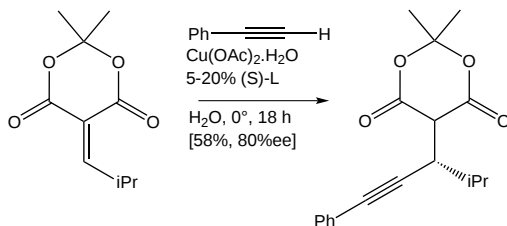
1. The PINAP family of P,N ligands is a synthetically more accessible but a similarly performing analog of the QUINAP (15-1777, 15-1778) ligand in enantioselective hydroboration, alkyne addition, and azomethine cycloaddition reactions. (Ref. 1)
2. With copper, enantioselective addition of alkynes to aldehydes to synthesize propargylamines.
3. With copper, catalytic, enantioselective, conjugate alkyne addition in aqueous media.

PHOSPHORUS - Ligands and Compounds

15-1784 (continued) **(R)-(+)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethyl]-1-phthalazin-amine, min. 97% (R,R)-N-PINAP (828927-97-5)**



Tech. Note (2)
Ref. (1,2)



Tech. Note (3)
Ref. (3)

References:

1. *Angew. Chem. Int. Ed.*, **2004**, 43, 5971.
2. *Org. Lett.*, **2006**, 8, 2437.
3. *J. Am. Chem. Soc.*, **2005**, 127, 9682.

15-1787 (R)-(+)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(S)-1-phenylethyl]-1-phthalazinamine, min. 97% (S,R)-N-PINAP (1173836-08-2)
C₃₈H₃₀N₂P; FW: 559.64; colorless xtl.; m.p. >210°
air sensitive
Note: PINAP Ligand Kit component.

250mg
1g

Technical Note:

1. See 15-1784 (page 223)

15-1786 (S)-(-)-4-[2-(Diphenylphosphino)-1-naphthalenyl]-N-[(R)-1-phenylethyl]-1-phthalazinamine, min. 97% (R,S)-N-PINAP (828927-96-4)
C₃₈H₃₀N₂P; FW: 559.64; colorless xtl.; m.p. >210°
air sensitive
Note: PINAP Ligand Kit component.

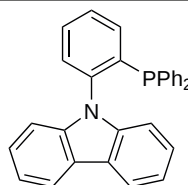
250mg
1g

Technical Note:

1. See 15-1784 (page 223)

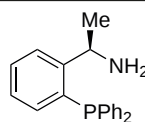
15-0498 9-[2-(Diphenylphosphino)phenyl]-9H-carbazole, min. 97% Ph PhenCar-Phos (1308652-67-6)
C₃₀H₂₂NP; FW: 427.48; white pwdr.
air sensitive
Note: PhenCar-Phos Ligand Kit component.

250mg
1g



15-7118 (R)-1-[2-(Diphenylphosphino)phenyl]ethylamine, min. 97% (192057-60-6)
C₂₀H₂₀NP; FW: 305.35; white solid
air sensitive

250mg
1g

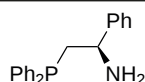


15-7119 (S)-1-[2-(Diphenylphosphino)phenyl]ethylamine, min. 97% (913196-43-7)
C₂₀H₂₀NP; FW: 305.35; white solid
air sensitive

250mg
1g

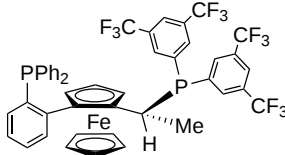
15-7121 (R)-2-(Diphenylphosphino)-1-phenylethylamine, min. 97% (141096-35-7)
C₂₀H₂₀NP; FW: 381.45; white solid
air sensitive

250mg
1g



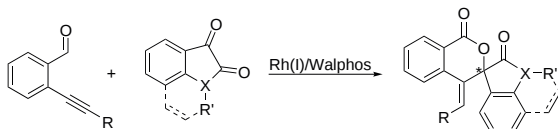
PHOSPHORUS - Ligands and Compounds

15-7122	(S)-2-(Diphenylphosphino)-1-phenylethylamine, min. 97% (1103533-85-2) $C_{20}H_{20}NP$; FW: 381.45; white solid <i>air sensitive</i>	250mg 1g
26-1300	(R)-(-)-1-[(R)-2-(2'-Di-phenylphosphinophenyl)ferrocenyl]ethylbis(di-3,5-trifluoromethylphenyl)phosphine, min. 97% (565184-33-0) $C_{46}H_{32}F_{12}FeP_2$; FW: 930.52; orange powdr. Note: Sold in collaboration with Solvias for research purposes only. Solvias Walphos Ligand Kit component.	100mg 500mg 2g 10g

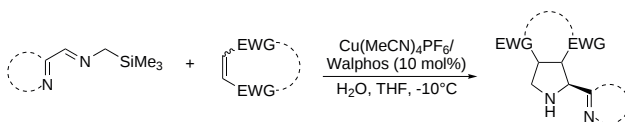


Technical Notes:

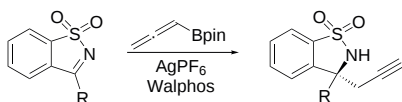
- Ligand for Rhodium-catalyzed enantioselective synthesis of spirocyclic benzopyranones by intermolecular[4+2]annulation.
- Ligand for Copper-catalyzed enantioselective synthesis of α -heteroarylpyrrolidines by 1,3-cycloaddition of α -silylimines.
- Ligand for Silver-catalyzed enantioselective propargylation reactions of N-sulfonylketimines.
- Ligand for Rhodium-catalyzed enantioselective addition of arylboronic acids to cyclic ketimines.



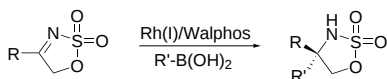
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

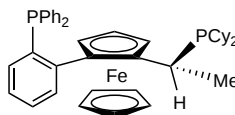


Tech. Note (4)
Ref. (4)

References:

- Angew. Chem., Int. Ed.* **2008**, 47, 5820.
- Org. Lett.*, **2014**, 16, 2228.
- Org. Lett.*, **2015**, 17, 5540.
- Org. Lett.*, **2015**, 17, 5520.

26-1310	(R)-(-)-1-[(R)-2-(2'-Di-phenylphosphino-phenyl)ferrocenyl]ethylidicyclohexylphosphine, min. 97% (565184-29-4) $C_{42}H_{48}FeP_2$; FW: 670.62; orange powdr. Note: Sold in collaboration with Solvias for research purposes only. Solvias Walphos Ligand Kit component.	100mg 500mg 2g 10g
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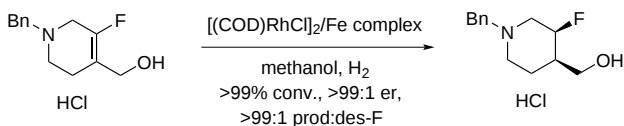


Technical Notes:

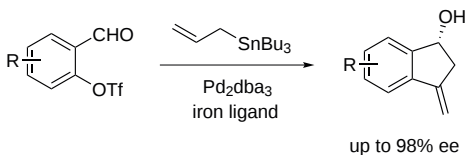
- Enantioselective synthesis of chiral fluoropiperidine via asymmetric hydrogenation of a vinyl fluoride.
- Palladium/ClickFerrophos – Catalyzed asymmetric domino allylstannylation-Heck reaction of o-formylaryl triflate.
- Catalytic asymmetric alkylation of acylsilanes.

PHOSPHORUS - Ligands and Compounds

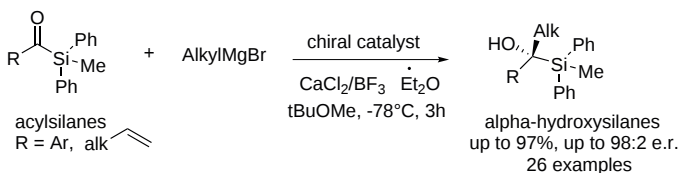
26-1310 (continued) (R)-(-)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylidicyclohexylphosphine, min. 97% (565184-29-4)



Tech. Note (2)
Ref. (2)



Tech. Note (2)
Ref. (2)

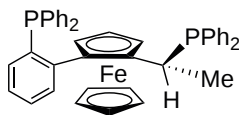


Tech. Note (3)
Ref. (3)

References:

1. *Tetrahedron*, **2009**, 65, 8987
2. *J. Org. Chem.*, **2014**, 79, 7905.
3. *Angew. Chem. Int. Ed.*, **2015**, 54, 3038.

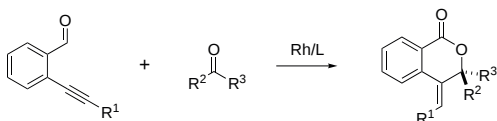
26-1315 (R)-(+)-1-[(R)-2-(2'-Di-phenylphosphinophenyl)ferrocenyl]ethylidiphenylphosphine, min. 97% (565184-32-9)
C₄₂H₃₆FeP₂; FW: 658.53; orange powd.
Note: Sold in collaboration with Solvias for research purposes only. Solvias Walphos Ligand Kit component.



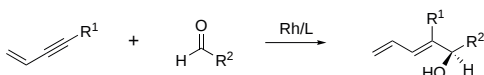
100mg
500mg
2g
10g

Technical Notes:

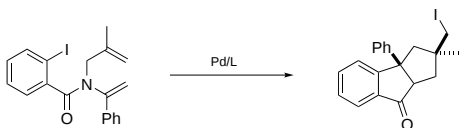
1. Ligand for Rh and Ru-catalyzed hydrogenation of alkenes and ketones.
2. Rh-catalyzed intermolecular [4+2].
3. Enantioselective reductive coupling of 1,3-enynes to heterocyclic aromatic aldehydes and ketones.
4. Pd-catalyzed enantioselective carbohalogenation.



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

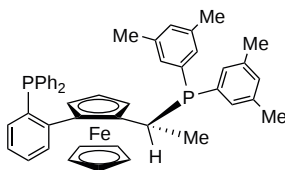
References:

1. (a) *Adv. Synth. Catal.*, **2003**, 345, 160, b, *Org. Lett.*, 2006, 8, 2413
2. *Angew. Chem.*, **2008**, 120, 5904
3. *J. Am. Chem. Soc.*, **2006**, 128, 16448
4. *J. Am. Chem. Soc.*, **2011**, 133, 14916

PHOSPHORUS - Ligands and Compounds

26-1320

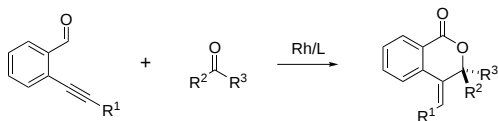
(R)-(+)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethylidene(3,5-xylyl)phosphine, min. 97%
(894771-25-6)
 $C_{46}H_{44}FeP_2$; FW: 714.63;
orange powdr.
(store cold)
Note: Sold in collaboration with Solvias for research purposes only. Solvias Walphos Ligand Kit component.



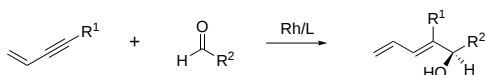
100mg
500mg
2g
10g

Technical Notes:

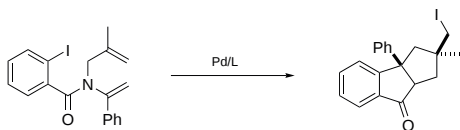
1. Ligand for Rh and Ru-catalyzed hydrogenation of alkenes and ketones.
2. Rh-catalyzed intermolecular [4+2].
3. Enantioselective reductive coupling of 1,3-enynes to heterocyclic aromatic aldehydes and ketones.
4. Pd-catalyzed enantioselective carbohalogenation.



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



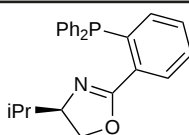
Tech. Note (4)
Ref. (4)

References:

1. (a) *Adv. Synth. Catal.*, **2003**, 345, 160, (b) *Org. Lett.*, **2006**, 8, 2413
2. *Angew. Chem.*, **2008**, 120, 5904
3. *J. Am. Chem. Soc.*, **2006**, 128, 16448
4. *J. Am. Chem. Soc.*, **2011**, 133, 14916

15-1821

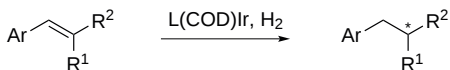
(R)-(+)-2-[2-(Diphenylphosphino)phenyl]-4-(1-methylethyl)-5,5-dihydrooxazole, 98% (R)-iPr-PHOX (164858-78-0)
 $C_{24}H_{24}NOP$; FW: 373.44; white powdr.;
m.p. 77-80°
air sensitive



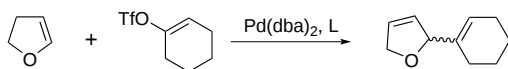
50mg
250mg
1g

Technical Notes:

1. Chiral ligand used in the asymmetric reduction of highly substituted olefins.
2. Chiral ligand used in the enantioselective Heck reaction. The success of the reaction is due to the fact that the catalytic system does not promote double bond isomerization.
3. Chiral ligand used in the enantioselective palladium-catalyzed allylic substitution of sodium benzotriazole.
4. Decarboxylative allylic alkylation.



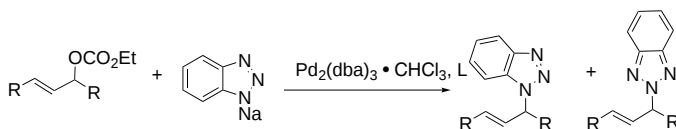
Tech. Note (1)
Ref. (1,3)



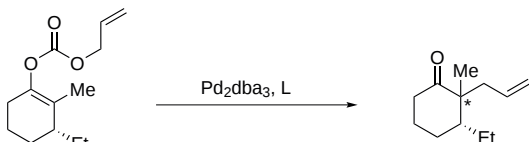
Tech. Note (2)
Ref. (2,3)

PHOSPHORUS - Ligands and Compounds

15-1821 (R)-(+)-2-[2-(Diphenylphosphino)phenyl]-4-(1-methylethyl)-4,5-dihydrooxazole, 98%
(continued) (R)-iPr-PHOX (164858-78-0)



Tech. Note (3)
Ref. (4)



Tech. Note (4)
Ref. (5)

References:

1. *Angew. Chem. Int. Ed.*, **1998**, 37, 2897
2. *Angew. Chem. Int. Ed.*, **1996**, 35, 200
3. *Acc. Chem. Res.*, **2000**, 33, 336
4. *Eur. J. Org. Chem.*, **2011**, 31, 6288
5. *Org. Lett.*, **2014**, 16, 118

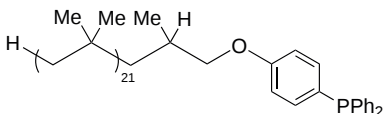
15-1822 (S)-(-)-2-[2-(Diphenylphosphino)phenyl]-4-(1-methylethyl)-4,5-dihydrooxazole, 98% (S)-iPr-PHOX (148461-14-7)
C₂₄H₂₄NOP; FW: 373.44; white powdr.; m.p. 77-80°
air sensitive

50mg
250mg
1g

Technical Note:

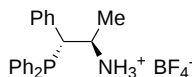
1. See 15-1821 (page 227)

15-3152 4-Diphenylphosphino-phenyl{2-methyl-3-[polyisobutyl(21)]propyl}ether (50% in heptane/polyisobutylene)
H[CH₂C(Me)₂]₂₁CH₂C(Me)HCH₂OC₆H₄-P(Ph)₂; FW: 1513; colorless liq.



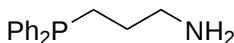
1g
5g

15-7159 (1R,2R)-1-(Diphenylphosphino)-1-phenylpropan-2-ammonium tetrafluoroborate, min. 97%
C₂₁H₂₃BF₄NP; FW: 407.19; white solid
air sensitive
Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.



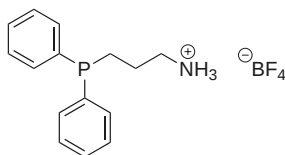
100mg
500mg

15-1767 3-(Diphenylphosphino)propylamine, min. 97% (16605-03-1)
(C₆H₅)₂P(CH₂)₃NH₂; FW: 243.28; colorless to pale yellow liq.
air sensitive



500mg
2g

15-1769 3-(Diphenylphosphino)propylammonium tetrafluoroborate
(C₆H₅)₂PCH₂CH₂CH₂NH₃⁺(BF₄⁻); FW: 331.10; white solid
air sensitive, hygroscopic
Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.



500mg
2g

PHOSPHORUS - Ligands and Compounds

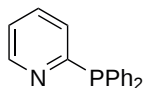
15-1780

NEW

2-Diphenylphosphinopyridine, min. 97%

(37943-90-1)

C₁₇H₁₄NP; FW: 263.27; white to off-white solid

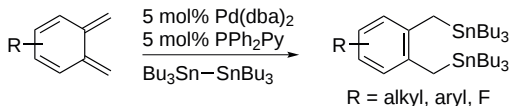


5g

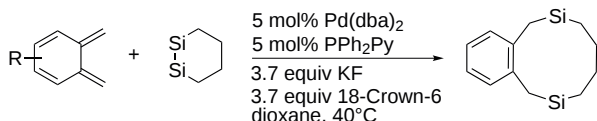
25g

Technical Notes:

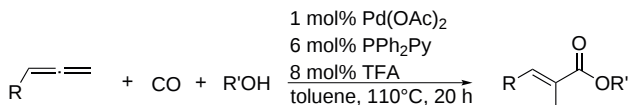
1. Ligand for the palladium-catalyzed distannylation of ortho-quinodimethanes
2. Ligand for the palladium-catalyzed disilylation of o-quinodimethanes to synthesize 9- and 10-membered disilacarbocycles
3. Ligand for the palladium-catalyzed alkoxy carbonylation of allenes



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

1. *Org. Lett.*, **2006**, 8, 4157
2. *Org. Lett.*, **2008**, 10, 4319
3. *J. Am. Chem. Soc.*, **2015**, 137, 8556

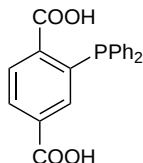
15-7170

2-(Diphenylphosphino)terephthalic acid, 98%

(1537175-69-1)

C₂₀H₁₈O₄P; FW: 350.30; white powdr.

Note: Ligand for MOF synthesis. Developed at the Paul Scherrer Institute, Switzerland PCT/EP2013/051405.

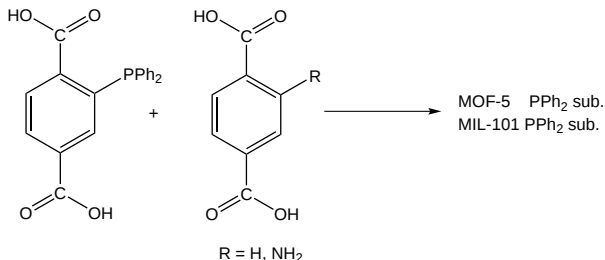


50mg

250mg

Technical Note:

1. Starting material for the construction of diphenylphosphino-substituted MOFs.

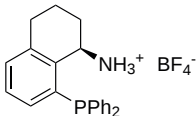
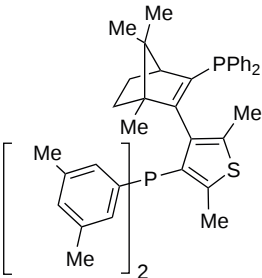
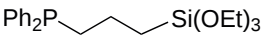
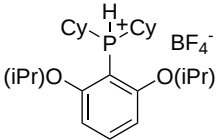


Tech. Note (1)
Ref. (1)

References:

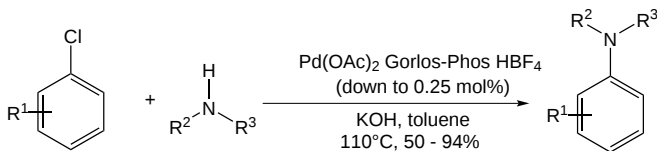
1. *Ind. Eng. Chem. Res.*, **2014**, 53, 9120.

PHOSPHORUS - Ligands and Compounds

15-7189	(R)-8-(Diphenylphosphino)-1,2,3,4-tetrahydronaphthalenaminate tetrafluoroborate, min. 97% $C_{22}H_{23}BF_4NP$; FW: 419.20; white solid <i>air sensitive</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.		100mg 500mg
15-0164	(+)-[4-[(1R,4S)-3-(Diphenylphosphino)-1,7,7-trimethylbicyclo[2.2.1]hept-2-en-2-yl]-2,5-dimethyl-3-thien-3-yl]bis(3,5-dimethylphenyl)phosphine, min. 95% [catASium® T3] (868851-50-7) $C_{44}H_{48}P_2S$; FW: 670.87; white powdr. <i>air sensitive, light sensitive</i> Note: Sold in collaboration with Solvias for research purposes only. Patent WO2005/108407.		100mg
15-1827	Diphenyl(m-sulfonatophenyl)phosphine dihydrate sodium salt, min. 90% (63995-75-5) $(C_6H_5)_2P(C_6H_4SO_3Na) \cdot 2H_2O$; FW: 364.33 (400.36); white powdr.		250mg 1g 5g
Technical Note: 1. A water-soluble phosphine ligand used in the formation of water-soluble catalysts.			
15-1825	Diphenyl(p-sulfonatophenyl)phosphine monohydrate dimethylsulfide adduct, potassium salt $(C_6H_5)_2P(C_6H_4SO_3K) \cdot H_2O \cdot CH_3SOCH_3$; FW: 380.44 (476.59); white powdr. Note: Water soluble phosphine.		1g 5g
15-1823	Diphenyl[3-(triethoxysilyl)propyl]phosphine, 98% (52090-23-0) $(C_6H_5)_2P(CH_2)_3Si(OCH_2CH_3)_3$; FW: 390.53; colorless, oily liq. <i>air sensitive, moisture sensitive</i>		250mg 1g
Technical Note: 1. Useful ligand for the preparation of silica-immobilized metal catalysts.			
15-6525	[2,6-Di-i-propoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98% GorlosPhosHBF₄ (1268824-70-9) $C_{24}H_{40}BF_4O_2P$; FW: 478.35; white solid; m.p. 221.6-223.2° Note: Sold under license from ZJU for research purposes only. Patents ZL200910154029.4, PCT/CN2009/001527.		500mg 2g

Technical Notes:

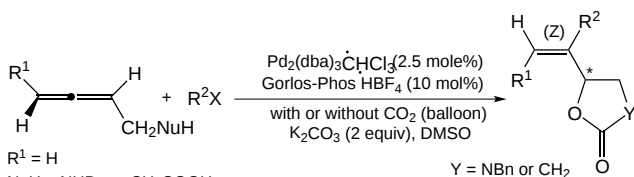
1. A new ligand for the palladium-catalyzed amination reactions of aryl chlorides with potassium hydroxide as the base.
2. A new ligand for the palladium-catalyzed exo-mode cyclization of allenes with a nucleophilic functionality.



Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-6525 [2,6-Di-*i*-propoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98%
(continued) GorlosPhosHBF₄ (1268824-70-9)

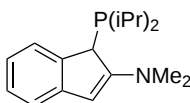


Tech. Note (2)
Ref. (2)

References:

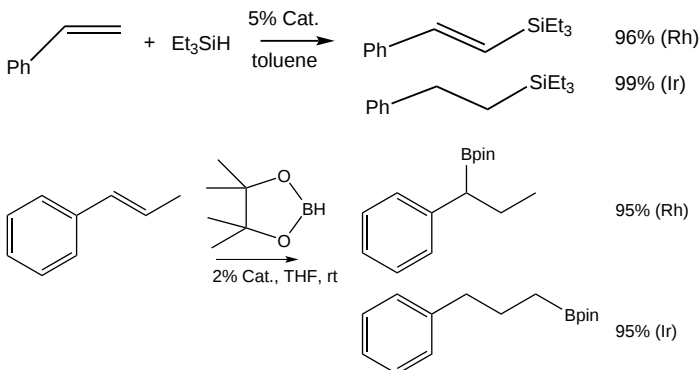
1. *Adv. Synth. Catal.*, **2011**, 353, 100.
2. *Org. Biomol. Chem.*, **2013**, 11, 5370.

15-1800	Di-<i>i</i>-propylchlorophosphine, min. 97% (40244-90-4)	1g
amp	(C ₃ H ₇) ₂ PCl; FW: 152.60; colorless liq.; f.p. 39°F; d. 0.959	5g
HAZ	<i>air sensitive, moisture sensitive</i>	
15-1795	Di-<i>i</i>-propylphosphine, 98% (20491-53-6)	1g
HAZ	(C ₃ H ₇) ₂ PH; FW: 118.16; colorless liq.	5g
	<i>air sensitive, pyrophoric</i>	
15-1796	Di-<i>i</i>-propylphosphine, 98% (10 wt% in hexanes) (20491-53-6)	10g
HAZ	(C ₃ H ₇) ₂ PH; FW: 118.16; colorless liq.	50g
	<i>air sensitive</i>	
15-1802	1-Di-<i>i</i>-propylphosphino-2-(<i>N,N</i>-dimethylamino)-1<i>H</i>-indene, 99% (540492-51-1)	250mg
	C ₁₇ H ₂₆ NP; FW: 275.37; off-white xtl.	1g
	<i>air sensitive</i>	
	Note: Sold under license from Dalhousie for research purposes only. Provisional US patents 60/778,368 and 60/778,358.	



Technical Note:

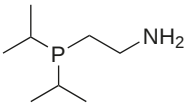
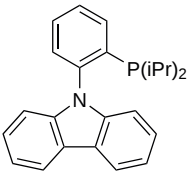
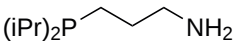
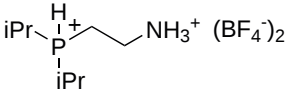
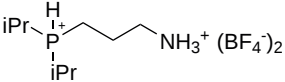
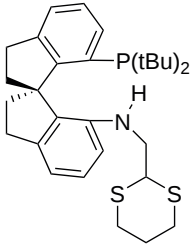
1. Zwitterionic hydrogenation, hydrosilylation and hydroboration catalyst soluble in non-polar solvents.



References:

1. *Organometallics*, **2007**, 26, 594.
2. *Organometallics*, **2006**, 25, 5965.

PHOSPHORUS - Ligands and Compounds

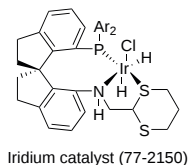
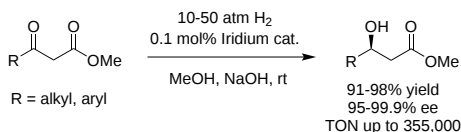
15-1812 HAZ	2-(Di-i-propylphosphino)ethylamine, min. 97% (10 wt% in THF) (1053657-14-9) $(C_3H_7)_2PCH_2CH_2NH_2$; FW: 161.23; pale yellow to colorless liq. <i>air sensitive, moisture sensitive</i>		5g 25g
15-0493	9-[2-(Di-i-propylphosphino)phenyl]- 9H-carbazole, min. 97% i-Pr PhenCar-Phos (1308652-65-4) $C_{24}H_{28}NP$; FW: 359.44; white powdr.; m.p. 145-149° <i>air sensitive</i> Note: PhenCar-Phos Ligand Kit component.		250mg 1g
15-1831 HAZ	3-(Di-i-propylphosphino)propylamine, min. 97% (10 wt% in THF) (1196147-69-9) $(C_3H_7)_2PCH_2CH_2CH_2NH_2$; FW: 175.25; colorless to pale yellow liq. <i>air sensitive</i>		5g 25g
93-1527	Di-i-propylphosphite, min. 98% (1809-20-7) $(C_3H_7O)_2P(O)H$; FW: 166.16; colorless liq.; b.p. 70-71°/9 mm; f.p. 156°F; d. 0.997 <i>moisture sensitive</i>		50g 250g
15-1813	2-(Di-i-propylphosphonium)ethylammonium bis(tetrafluoroborate), min. 97% (1222630-50-3) $(C_3H_7)_2PH^+CH_2CH_2NH_3^+(BF_4)_2$; FW: 336.85; white to beige solid <i>air sensitive, hygroscopic</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.		500mg 2g
15-1832	3-(Di-i-propylphosphonium)propylammonium bis(tetrafluoroborate) $(C_3H_7)_2PH^+CH_2CH_2CH_2NH_3^+(BF_4)_2$; FW: 350.88; white solid <i>air sensitive, hygroscopic</i> Note: Sold under license from Kanata for research purposes only. PCT/CA2009/001412.		500mg 2g
15-1638 NEW	(R)-(+)-7-[N-(1,3-Dithian-2-yl)methylamino]-7'-[bis(3,5-di-t-butylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobindane, 97+% (>99% ee) [(R)-DTB-SpiroSAP] (1809609-53-7) $C_{50}H_{68}NPS_2$; FW: 776.17; white to off-white solid; m.p. 95-97° <i>air sensitive</i>		25mg 100mg

Technical Note:

- Chiral P-N-S Spiro Ligand used in the Iridium-catalyzed asymmetric Hydrogenation of Ketoesters

PHOSPHORUS - Ligands and Compounds

15-1638 (R)-(+)-7-[N-(1,3-Dithian-2-yl)methylamino]-7'-[bis(3,5-di-*t*-butylphenyl)phosphino]-
(continued) **2,2',3,3'-tetrahydro-1,1'-spirobindane, 97+% (>99% ee) [(R)-DTB-SpiroSAP]** (1809609-53-7)



Tech. Note (1)
Ref. (1)

References:

1. *Angew. Chem. Int. Ed.* **2015**, 54, 8791

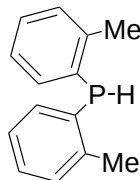
15-1639	(S)-(-)-7-[N-(1,3-Dithian-2-yl)methylamino]-7'-[bis(3,5-di-<i>t</i>-butylphenyl)phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobindane, 97+% (>99% ee) [(S)-DTB-SpiroSAP]	25mg 100mg
NEW	$\text{C}_{50}\text{H}_{66}\text{NPS}_2$; FW: 776.17; white to off-white solid; m.p. 95-97° <i>air sensitive</i>	

Technical Note:

1. See 15-1638 (page 232)

15-1815	Di-<i>o</i>-tolylchlorophosphine, min. 98% (36042-94-1)	1g 5g
HAZ	$(\text{CH}_3\text{C}_6\text{H}_4)_2\text{PCl}$; FW: 248.69; white to yellow hazy viscous liq. <i>air sensitive, moisture sensitive</i>	

15-0435	Di-<i>o</i>-tolylphosphine, min. 97% (29949-64-2)	1g 5g
	$(\text{CH}_3\text{C}_6\text{H}_4)_2\text{PH}$; FW: 214.24; colorless solid; m.p. 42-46° <i>air sensitive</i>	

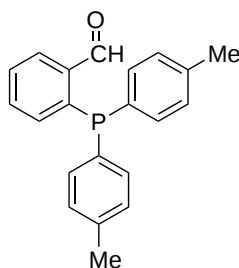


15-1820	Di-<i>p</i>-tolylphosphine, 99% (1017-60-3)	2g 10g
amp HAZ	$(\text{CH}_3\text{C}_6\text{H}_4)_2\text{PH}$; FW: 214.25; colorless liq. <i>pyrophoric</i>	



15-1819	Di-<i>p</i>-tolylphosphine, 99% (10 wt% in hexanes) (1017-60-3)	20g 100g
HAZ	$(\text{CH}_3\text{C}_6\text{H}_4)_2\text{PH}$; FW: 214.25; colorless liq. <i>air sensitive</i>	

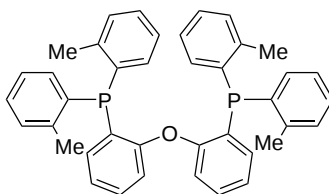
15-7344	2-(Di-<i>p</i>-tolylphosphino)benzaldehyde, min. 97% (1202865-03-9)	500mg 2g
	$\text{C}_{21}\text{H}_{19}\text{OP}$; FW: 318.12; yellow solid	



PHOSPHORUS - Ligands and Compounds

15-7365

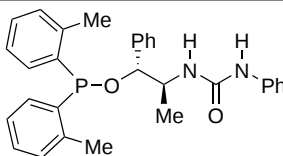
**2,2'-(Di-o-tolylphosphino)
diphenylether, min. 97%**
DTP-DPEphos (205497-64-9)
 $C_{40}H_{36}OP_2$; FW: 594.66; white
powdr.



250mg
1g

15-2214

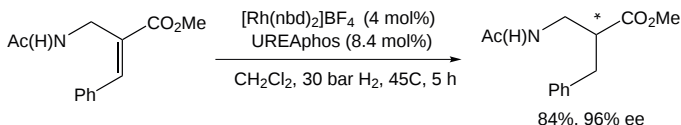
**1-[(1R,2S)-1-(Di-o-tolylphos-
phinooxy)-1-phenylpropan-
2-yl]-3-phenylurea, min. 97%**
(1391410-56-2)
 $C_{30}H_{31}N_2O_2P$; FW: 482.55; white
powdr.
moisture sensitive, (store cold)
Note: Sold under license from
InCatT for research purposes only.
WO2004/103559. UREAPhos
and METAMORPhos Ligand Kit
component.



50mg
250mg

Technical Note:

- The UREAPhos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.

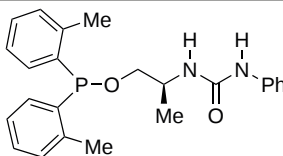


References:

- J. Chem. Soc. Chem. Comm., **2007**, 864.
- WO2004103559A2.

15-2212

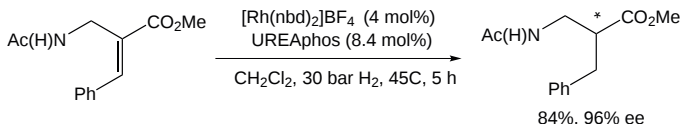
**1-[(2S)-1-(Di-o-tolylphosphinoxy)
propan-2-yl]-3-phenylurea, min.
97%**
 $C_{24}H_{27}N_2P$; FW: 406.46; white powdr.
moisture sensitive, (store cold)
Note: Sold under license from
InCatT for research purposes only.
WO2004/103559. UREAPhos
and METAMORPhos Ligand Kit
component.



50mg
250mg

Technical Note:

- The UREAPhos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.

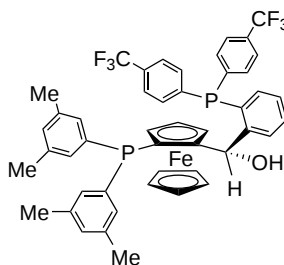


References:

- J. Chem. Soc. Chem. Comm., **2007**, 864.
- WO2004103559A2.

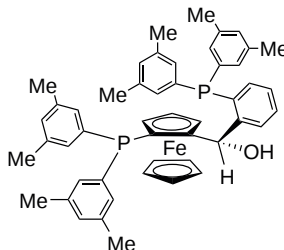
PHOSPHORUS - Ligands and Compounds

26-1560 (S)-(-)-[(S)-2-Di(3,5-xylyl)phosphinoferrocenyl][2-di(4-trifluoromethylphenyl)phosphinophenyl]methanol, min. 97% (851308-48-0)
 $C_{47}H_{40}F_6FeOP_2$; FW: 852.60;
 yellow powd.
 Note: Air-stable. Sold in collaboration with Solvias for research purposes only.
 Limited quantities available



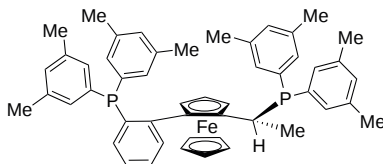
100mg

26-1565 (S)-(-)-[(S)-2-Di(3,5-xylyl)phosphinoferrocenyl][2-di(3,5-xylyl)phosphinophenyl]methanol, min. 97% (851308-45-7)
 $C_{49}H_{50}FeOP_2$; FW: 772.71; orange foam
 Note: Air-stable. Sold in collaboration with Solvias for research purposes only.



100mg
500mg

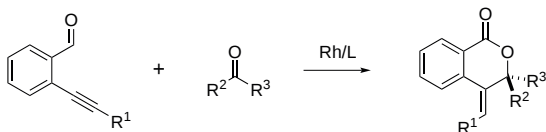
26-1555 (R)-(+)-1-[(R)-2-(2'-Di-3,5-xylylphosphinophenyl)ferrocenyl]ethyl-di-3,5-xylylphosphine, min. 97% (894771-28-9)
 $C_{50}H_{52}FeP_2$; FW: 770.74; orange-red solid
 Note: Sold in collaboration with Solvias for research purposes only. Solvias Walphos Ligand Kit component.



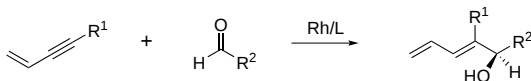
100mg
500mg
2g
10g

Technical Notes:

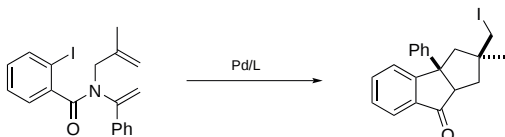
1. Ligand for Rh and Ru-catalyzed hydrogenation of alkenes and ketones.
2. Rh-catalyzed intermolecular [4+2].
3. Enantioselective reductive coupling of 1,3-enynes to heterocyclic aromatic aldehydes and ketones.
4. Pd-catalyzed enantioselective carbohalogenation.



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

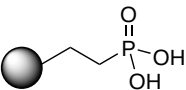
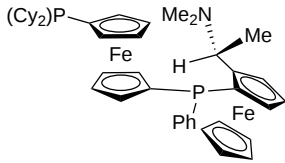
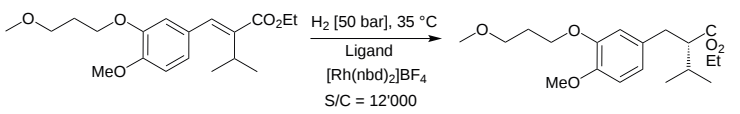


Tech. Note (4)
Ref. (4)

References:

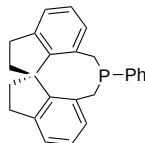
1. (a) *Adv. Synth. Catal.*, **2003**, 345, 160, (b) *Org. Lett.*, **2006**, 8, 2413
2. *Angew. Chem.*, **2008**, 120, 5904
3. *J. Am. Chem. Soc.*, **2006**, 128, 16448
4. *J. Am. Chem. Soc.*, **2011**, 133, 14916

PHOSPHORUS - Ligands and Compounds

15-1835	n-Dodecylphosphonic acid, min. 97% DDPA (5137-70-2) $\text{CH}_3(\text{CH}_2)_{11}\text{P}(\text{O})(\text{OH})_2$; FW: 250.31; white to off-white powdr.; m.p. 96-98° Note: Long-Chain n-Alkylphosphonic Acid Kit component.	1g 5g
15-0011	Ethyl/butyl phosphonic acid Silica (PhosphonicS POH1) white solid; SA: 380 m ² /g Note: Sold in collaboration with PhosphonicS Ltd. for research purposes only.	10g 50g
		
Particle size range: 60-200 microns Average pore size: 60Å Functional group loading : 0.8 to 1.0 mmol/g		
Technical Note: 1. Applications include esterification, trans-esterification, hydrolysis, rearrangements, dehydration, protection and de-protection, cyclizations, etherifications. At the end of the reaction the solid silica catalyst can simply be filtered from the reaction mixture and reused.		
References: 1. <i>Org. Process Res. Dev.</i> , 2007 , <i>11</i> , 406.		
15-2100 amp HAZ 	Ethylidichlorophosphine, 98% (1498-40-4) $\text{C}_2\text{H}_5\text{PCl}_2$; FW: 130.94; colorless liq.; b.p. 113-116°; f.p. 91°F; d. 1.26 <i>air sensitive, moisture sensitive, pyrophoric</i>	5g 25g
15-2150 HAZ	Ethylidiphenylphosphine, 99% (607-01-2) $(\text{C}_2\text{H}_5)(\text{C}_6\text{H}_5)_2\text{P}$; FW: 214.25; colorless liq.; b.p. 130-132°/1 mm; f.p. >230°F; d. 1.04 <i>air sensitive</i>	5g 25g
15-2301	Ethyltriphenylphosphonium bromide, 99% (1530-32-1) $\text{C}_2\text{H}_5(\text{C}_6\text{H}_5)_3\text{PBr}$; FW: 371.26; white to off-white powdr.; m.p. 206-208°	25g 100g
26-1266	1-([(R)-Ferrocenyl-2-(S)-ethyl-1-dimethylamino)phenyl]-(R)-phosphino)-1'-dicyclohexylphosphino-ferrocene, min. 97% Chenphos (952586-19-5) $\text{C}_{42}\text{H}_{53}\text{Fe}_2\text{NP}_2$; FW: 745.51; orange powdr. Note: Sold in collaboration with Solvias for research purposes only.	100mg 500mg 2g 10g
		
Technical Note: 1. 1. Ligand used for the Rh-catalyzed asymmetric hydrogenation of α-substituted acrylic acids.		
		
References: 1. Patent number US 8,106,227, B2.		
26-1265	1-([(S)-Ferrocenyl-2-(R)-ethyl-1-dimethylamino)phenyl]-(S)-phosphino)-1'-dicyclohexylphosphinoferrocene, min. 97% Chenphos (1036373-39-3) $\text{C}_{42}\text{H}_{53}\text{Fe}_2\text{NP}_2$; FW: 745.51; orange powdr. Note: Sold in collaboration with Solvias for research purposes only.	100mg 500mg 2g 10g
Technical Note: 1. See 26-1266 (page 236)		
93-1529 HAZ	Fluorophosphoric acid, 60-70% (13537-32-1) $(\text{HO})_2\text{P}(\text{O})\text{F}$; FW: 100.00; yellow liq. <i>moisture sensitive</i>	50g 250g

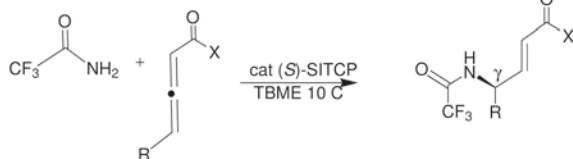
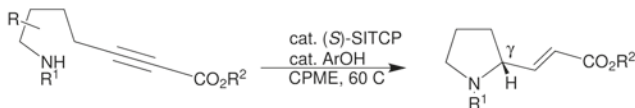
PHOSPHORUS - Ligands and Compounds

15-2400	n-Hexadecylphosphonic acid, min. 97% HDPA (4721-17-9) $\text{CH}_3(\text{CH}_2)_{15}\text{P}(\text{O})(\text{OH})_2$; FW: 306.42; white to off-white powdr.; m.p. 96-99° Note: Long-Chain n-Alkylphosphonic Acid Kit component.	1g 5g
93-1581	Hexadecyltri-n-butylphosphonium bromide, 98+% (14937-45-2) $(\text{C}_{16}\text{H}_{33})(\text{C}_4\text{H}_9)_3\text{PBr}$; FW: 507.65; white xtl.; m.p. 54-56°	10g 50g
93-1531 HAZ	Hexafluorophosphoric acid, 60-70% in water (16940-81-1) HPF_6 ; FW: 145.97; colorless to pale yellow liq.	250g 1kg
15-5184	(11aR)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1-cd:1',7'-ef]phosphocin, min. 97% (R)-SITCP (856407-37-9) $\text{C}_{25}\text{H}_{23}\text{P}$; FW: 354.42; white solid; m.p. 148-149° <i>air sensitive</i>	25mg 100mg

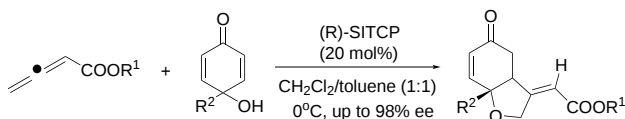


Technical Notes:

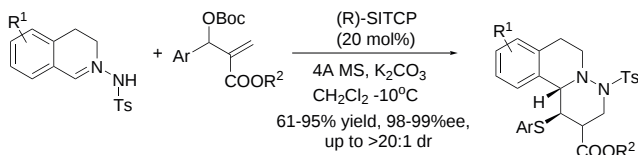
- Chiral catalyst for the intra and intermolecular γ -addition of nitrogen nucleophiles to γ -substituted alkynoates or allenates
- Phosphine-catalyzed β, γ -umpolung domino reaction of allenic esters: facile synthesis of tetrahydrobenzofuranones bearing a chiral tetrasubstituted stereogenic carbon center.
- Phosphine-catalyzed highly enantioselective [3+3] cycloaddition of Morita-Baylis-Hillman carbonates with C,N-cyclic azomethine imines.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

- Angew. Chem. Int. Ed.*, **2013**, 52, 2525.
- Angew. Chem. Int. Ed.*, **2015**, 54, 1511.
- J. Am. Chem. Soc.*, **2015**, 137, 4316.

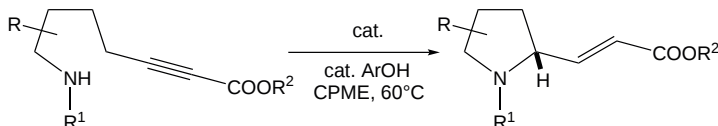
PHOSPHORUS - Ligands and Compounds

15-5185 (11aS)-(+)-5,6,10,11,12,13-Hexahydro-5-phenyl-4H-diindeno[7,1-cd:1',7'-ef]phosphocin, min. 97% (S)-SITCP (885701-78-0)
 $C_{25}H_{23}P$; FW: 354.42; white solid; m.p. 148-149°
air sensitive

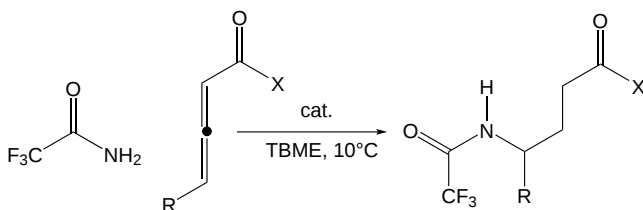
25mg
 100mg

Technical Notes:

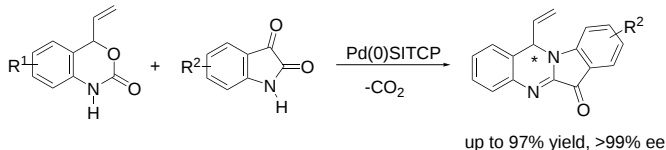
1. Phosphine-catalyzed intra- and intermolecular gamma-addition of nitrogen nucleophiles to allenates and alkynoates.
2. Catalytic asymmetric construction of the tryptanthrin skeleton via enantioselective decarboxylative [4+2] cyclization.
3. Catalytic, enantioselective carbon-oxygen bond formation – phosphorus-catalyzed synthesis of benzylic esters via oxidation of benzylic C-H bonds.
4. Use of a new spirophosphine to achieve catalytic, enantioselective [4+1] annulations of amines with allenes to generate dihydropyrroles.



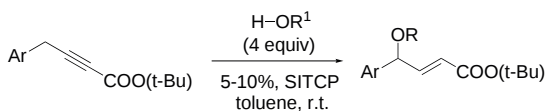
Tech. Note (1)
 Ref. (1)



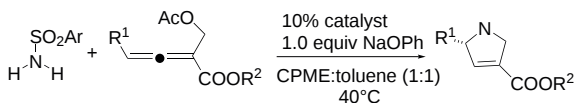
Tech. Note (1)
 Ref. (1)



Tech. Note (2)
 Ref. (2)



Tech. Note (3)
 Ref. (3)



Tech. Note (4)
 Ref. (4)

References:

1. *Angew. Chem. Int. Ed.*, **2013**, 52, 2525.
2. *Org. Lett.*, **2017**, 19, 3219.
3. *J. Am. Chem. Soc.*, **2016**, 138, 12069.
4. *J. Am. Chem. Soc.*, **2015**, 137, 3803.

15-2410 **n-Hexylphosphonic acid, min. 97% HPA (4721-24-8)**
 $CH_3(CH_2)_5P(O)(OH)_2$; FW: 166.16; white to off-white powder;
 m.p. 105-106°
 Note: Long-Chain n-Alkylphosphonic Acid Kit component.

1g
 5g

PHOSPHORUS - Ligands and Compounds

15-1392 NEW	(11bR)-4-Hydroxy-2,6-bis[4-(trifluoromethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 95%, (99% ee) (791616-59-6) $C_{34}H_{19}F_6O_4P$; FW: 636.5; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1393 NEW	(11bS)-4-Hydroxy-2,6-bis[4-(trifluoromethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 95%, (99% ee) (1264573-23-0) $C_{34}H_{19}F_6O_4P$; FW: 636.5; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1381	(11bR)-4-Hydroxy-2,6-bis[2,4,6-tris(1-methylethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (791616-63-2) $C_{50}H_{57}O_4P$; FW: 753.0; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1382 NEW	(11bS)-4-Hydroxy-2,6-bis[2,4,6-tris(1-methylethyl)phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (874948-63-7) $C_{50}H_{57}O_4P$; FW: 753; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1388 NEW	(11bR)-4-Hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (864943-23-7) $C_{40}H_{25}O_4P$; FW: 600.6; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1389 NEW	(11bS)-4-Hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (929097-93-8) $C_{40}H_{25}O_4P$; FW: 600.6; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		25mg 100mg
15-1390 NEW	(11bR)-4-Hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (791616-56-3) $C_{40}H_{25}O_4P$; FW: 600.6; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1391 NEW	(11bS)-4-Hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (874948-60-4) $C_{40}H_{25}O_4P$; FW: 600.6; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		25mg 100mg

PHOSPHORUS - Ligands and Compounds

15-1386

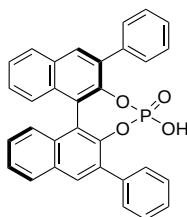
NEW

(11bR)-4-Hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (695162-86-8)

C₃₂H₂₁O₄P; FW: 500.5;

White to light-yellow powdr.

Note: Sold in collaboration with Daicel for research purposes only.



100mg

15-1387

NEW

(11bS)-4-Hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (874948-59-1)

C₃₂H₂₁O₄P; FW: 500.5; White to light-yellow powdr.

Note: Sold in collaboration with Daicel for research purposes only.

100mg

15-2900

1-Hydroxyethylidene-1,1-diphosphonic acid, min. 95% HEDP (2809-21-4)

C(OH)(CH₃)(PO₃H₂)₂; FW: 206.03; white powdr.

5g

25g

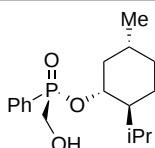
15-2928

(Sp)-Hydroxymethylphenylphosphinic acid [(1R,2S,2R)-2-i-propyl-5-methylcyclohexanol]ester, 99% (1508260-88-5)

C₁₇H₂₇O₃P; FW: 310.37; white powdr.

hygroscopic

Note: Patent pending 13/912,392



100mg

500mg

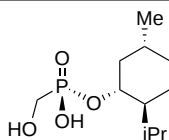
15-2915

(Rp)-Hydroxymethylphosphonic acid [(-)-(1R,2S,2R)-2-i-propyl-5-methylcyclohexanol]ester, 99% (1823532-14-4)

C₁₇H₂₃O₃P; FW: 234.27; white solid

hygroscopic, (store cold)

Note: Patent pending.



100mg

500mg

15-2975

N-(2-Methoxyphenyl)-2-(di-t-butylphosphino)pyrrole, min. 95% [cataCXium® POMetB] (1053658-91-5)

C₁₉H₂₈NOP; FW: 317.41;

white to yellowish powdr.

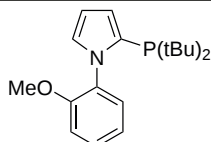
air sensitive

Note: Sold in collaboration with

Solvias for research purposes only.

Patent Application pending. Solvias

cataCXium® Ligand Kit component.

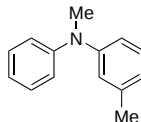
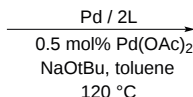


500mg

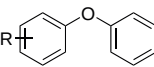
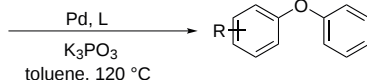
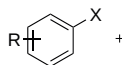
2g

Technical Notes:

1. Useful ligand for the Pd-catalyzed amination reaction.
2. Ligand used for the Pd-catalyzed arylation of phenols.
3. Useful ligand for the Suzuki-Miyaura coupling.
4. Ligand used for the Sonagashira reaction of aryl bromides.



Tech. Note (1)
Ref. (1)

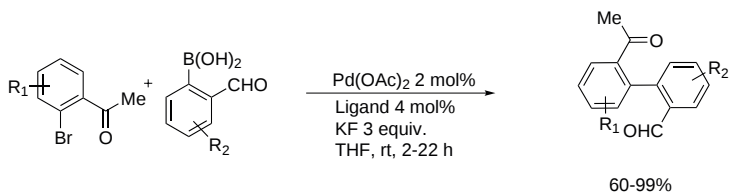


Tech. Note (2)
Ref. (2)

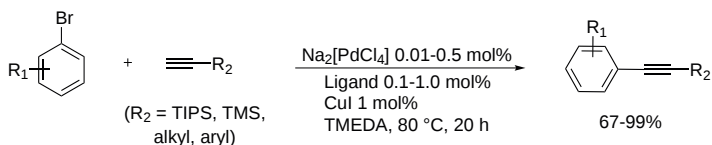
51-99%

PHOSPHORUS - Ligands and Compounds

15-2975 **N-(2-Methoxyphenyl)-2-(di-t-butylphosphino)pyrrole, min. 95% [cataCXium® POMetB]**
(continued) **(1053658-91-5)**



Tech. Note (3)
Ref. (3)

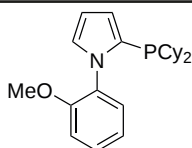


Tech. Note (4)
Ref. (4)

References:

1. *Chem. Eur. J.*, **2004**, 10, 2983
2. *J. Org. Chem.*, **2009**, 74, 3948.
3. *Chem. Sus. Chem.*, **2008**, 1, 91.
4. *Chem. Sus. Chem.*, **2008**, 1, 91.

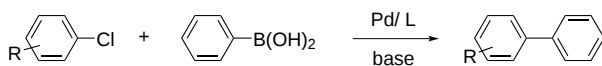
15-2980 **1-(2-Methoxyphenyl)-2-(dicyclohexylphosphino)pyrrole, min. 95%**
[cataCXium® POMeCy] (672937-63-2)
 $\text{C}_{23}\text{H}_{32}\text{NOP}$; FW: 369.48;
 white to yellow powdr.; m.p. 96-97°
air sensitive
 Note: Sold in collaboration with Solvias for research purposes only. Patent Application pending. Solvias cataCXium® Ligand Kit component.



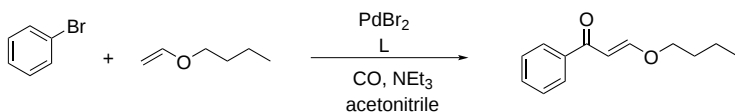
500mg
 2g

Technical Notes:

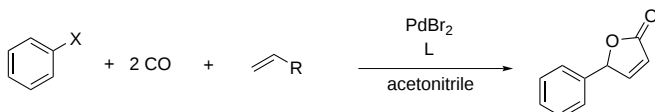
1. Highly efficient ligand for the palladium-catalyzed Suzuki reaction using aryl chlorides.
2. Carbonylative Heck reaction of aryl bromides with vinyl ethers.
3. Double carbonylation of aryl halides to synthesize 5-arylfuranones.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

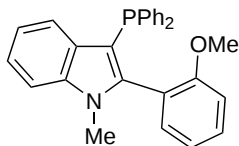
1. *Chem. Commun.*, **2004**, 38.
2. *Chem. Eur. J.*, **2012**, 18, 4827
3. *Chem. Eur. J.*, **2013**, 19, 12959

PHOSPHORUS - Ligands and Compounds

15-1091

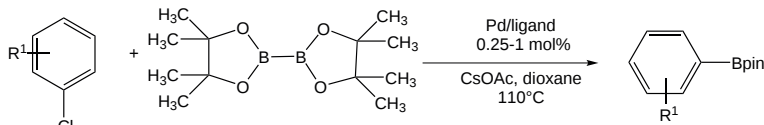
2-(2-Methoxyphenyl)-1-methyl-3-di-phenylphosphino)-1H-indole, min. 98% PPh₂-Andole-Phos (1242759-01-8)
C₂₈H₂₄NOP; FW: 421.47;
white to off-white powdr.

500mg
2g



Technical Note:

- Palladium-Indolylphosphine catalyzed borylation of nonactivated aryl chlorides.



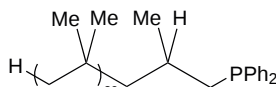
Tech. Note (1)
Ref. (1)

References:

- J. Org. Chem., 2012, 77, 3543.

15-3155
amp
HAZ

{2-Methyl-3-[polyisobutyl(20)]propyl} diphenylphosphine (50% in heptane/polyisobutylene)
H[CH₂C(Me)₂]₂₀CH₂C(Me)HCH₂P(Ph)₂;
FW: 1364; colorless liq.



1g
5g

15-3220

amp
HAZ

Methyldichlorophosphine, 97% (676-83-5)
CH₃PCl₂; FW: 116.92; colorless to pale yellow liq.; b.p. 81°; d. 1.31
air sensitive, moisture sensitive
Note: May be slightly turbid. For sale in USA. For other countries contact Strem.

5g
25g

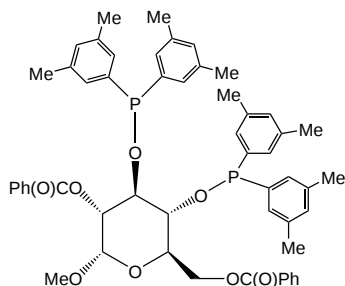
15-3250

Methyldiphenylphosphine, 99% (1486-28-8)
CH₃(C₆H₅)₂P; FW: 200.22; colorless liq.; b.p. 118-120°/2.2 mm;
f.p. >230°F; d. 1.065
air sensitive

5g
25g
100g

15-3300

Methyl α-D-glucopyranoside-2,6-dibenzoate-3,4-di(bis(3,5-dimethylphenyl)phosphinite), min. 95% CARBOPHO (158214-06-3)
C₅₃H₅₆O₈P₂; FW: 882.98; white powdr.;
m.p. 162-164°
air sensitive



100mg
500mg

Technical Note:

- Sugar-based phosphinite ligand used in the asymmetric reduction of prochiral acetamidoacrylates

References:

- J. Am. Chem. Soc., 1994, 116, 4101.
- J. Org. Chem., 1997, 62, 6012.

15-3400

Methyltriphenylphosphonium bromide, 98+% (1779-49-3)
CH₃(C₆H₅)₃PBr; FW: 357.23; white xtl.; m.p. 234-235°

50g
250g

93-4249

HAZ

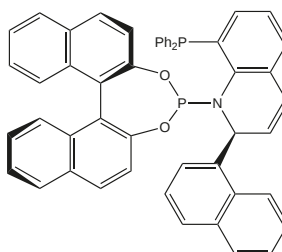
12-Molybdophosphoric acid hydrate (ACS) (51429-74-4)
H₃PO₄·12MoO₃·XH₂O; FW: 1825.25; yellow xtl.

10g
50g

PHOSPHORUS - Ligands and Compounds

15-1530

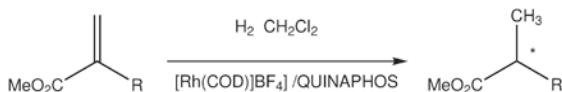
(S)-2-(1-Naphthyl)-8-diphenylphosphino-1-[(R)-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl]-1,2-dihydroquinoline toluene adduct, min. 97% (Ra,Sc)-(1-Nph)-Quinaphos (1242168-77-9)
 $C_{51}H_{35}NO_2P_2$; 1/2 C_7H_8 ;
 FW: 755.78 (801.85); white powdr.
moisture sensitive
 Note: **Limited quantities available**



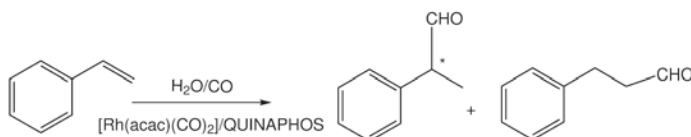
50mg
250mg

Technical Notes:

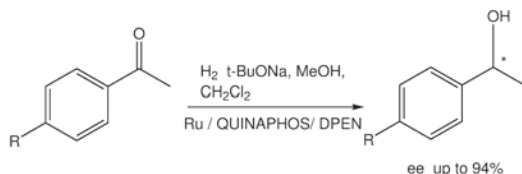
1. Ligand used for the highly active and enantioselective hydrogenation of functionalized olefins.
2. Useful ligand for the rhodium-catalyzed, asymmetric hydroformylation of styrenes.
3. Useful ligand for the ruthenium-catalyzed, enantioselective hydrogenation of aromatic ketones..



Tech. Note (1)
Ref. (1,3)



Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)

References:

1. *Angew. Chem. Int. Ed.*, **2000**, 39, 1428.
2. *Chem. Commun.*, **2005**, 3460.
3. *Chem. Eur. J.*, **2010**, 16, 7517.

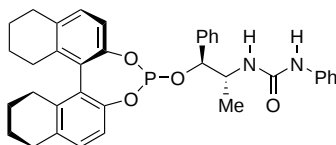
15-3490	(S)-(+)-Neomenthylidiphenylphosphine, 98% (S)-NMDPP (43077-29-8) $C_{10}H_{19}P(C_6H_5)_2$; FW: 324.25; white xtl.; m.p. 90-92° <i>air sensitive</i>	500mg 2g
93-0739 HAZ	Nitronium hexafluorophosphate, min. 97% (19200-21-6) NO_2PF_6 ; FW: 190.97; white xtl. <i>moisture sensitive</i>	10g
93-0736 HAZ	Nitrosonium hexafluorophosphate, min. 97% (16921-91-8) $NOPF_6$; FW: 174.96; white xtl. <i>moisture sensitive</i>	10g
15-3510	n-Octadecylphosphonic acid, min. 97% ODPa (4724-47-4) $CH_3(CH_2)_{17}P(O)(OH)_2$; FW: 334.47; white to off-white powdr.; m.p. 100-101° Note: Long-Chain n-Alkylphosphonic Acid Kit component.	1g 5g 25g

PHOSPHORUS - Ligands and Compounds

15-2224

1-[(1S,2R)-1-[(11bR)-8,9,10,11,12,13,14,15-Octahydrodronaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yloxy]-1-phenylpropan-2-yl]-3-phenylurea, min. 97% (1858224-21-1)

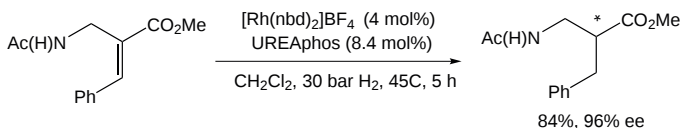
$C_{36}H_{37}N_2O_4P$; FW: 592.86;
white powdr.
moisture sensitive, (store cold)
Note: Sold under license from InCatT for research purposes only. WO2004/103559.
UREAphos and METAMORPhos Ligand Kit component.



50mg
250mg

Technical Note:

- The UREAphos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



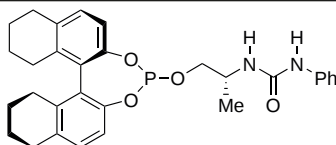
References:

- J. Chem. Soc. Chem. Comm., **2007**, 864.
- WO2004103559A2.

15-2222

1-[(2R)-1-[(11bR)-8,9,10,11,12,13,14,15-Octahydrodronaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin-4-yloxy]propan-2-yl]-3-phenylurea, min. 97% (1858223-90-1)

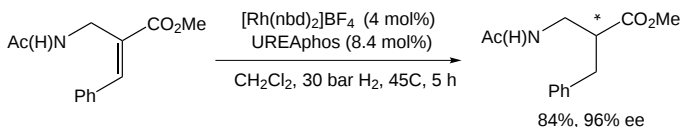
$C_{30}H_{33}N_2O_4P$; FW: 516.57;
white powdr.
moisture sensitive, (store cold)
Note: Sold under license from InCatT for research purposes only. WO2004/103559.
UREAphos and METAMORPhos Ligand Kit component.



50mg

Technical Note:

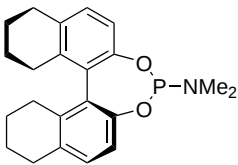
- The UREAphos ligands are a new class of ligands containing a urea group, which due to its self-complementary hydrogen bond character, enables the formation of bidentate ligands in a supramolecular fashion. This interesting feature makes this ligand class highly suitable for combinatorial approaches and high throughput experimentation.



References:

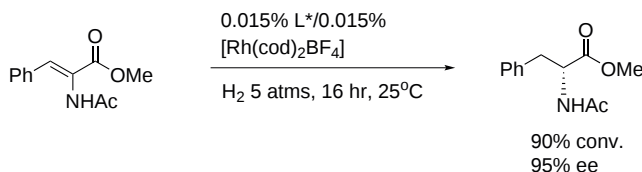
- J. Chem. Soc. Chem. Comm., **2007**, 864.
- WO2004103559A2.

PHOSPHORUS - Ligands and Compounds

15-3495	(S)-(+)-(8,9,10,11,12,13,14,15-Octahydro-3,5-dioxo-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, 99% (389130-06-7) C ₂₂ H ₂₆ NO ₂ P; FW: 367.42; white powdr.; m.p. 112-113° moisture sensitive, (store cold) Note: Sold in collaboration with DSM for research purposes only. Patent WO 0204466. DSM's MonoPhos™ Ligand Kit component.		100mg 500mg
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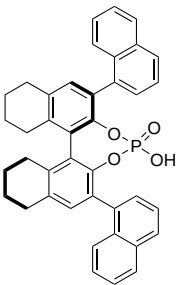
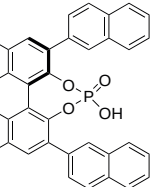
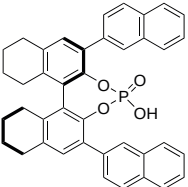
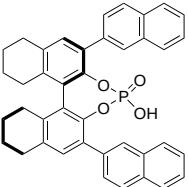
Technical Note:

1. A ligand for enantioselective hydrogenation of prochiral functional olefins.

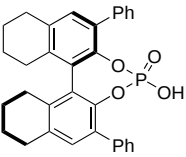
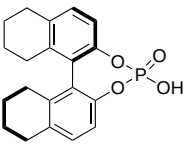
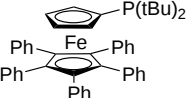


References:

1. *Adv. Synth. Catal.*, **2003**, 345, 308.

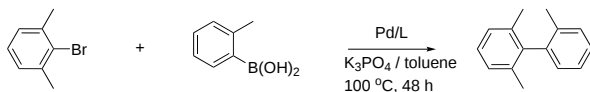
15-1383 NEW	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (1242066-20-1) C ₄₀ H ₃₃ O ₄ P; FW: 608.7; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		25mg 100mg
15-1384 NEW	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-1-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) C ₄₀ H ₃₃ O ₄ P; FW: 608.7; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		25mg 100mg
15-1378 NEW	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (922711-75-9) C ₄₀ H ₃₃ O ₄ P; FW: 608.7; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		25mg 100mg
15-1379 NEW	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-di-2-naphthalenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) C ₄₀ H ₃₃ O ₄ P; FW: 608.7; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		25mg 100mg

PHOSPHORUS - Ligands and Compounds

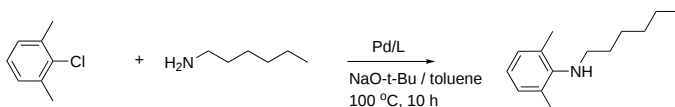
15-1396 NEW	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (791616-65-4) $C_{32}H_{29}O_4P$; FW: 508.5; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1397 NEW	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-diphenyl-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (945852-48-2) $C_{32}H_{29}O_4P$; FW: 508.5; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1370 NEW	(11bR)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (297752-25-1) $C_{26}H_{21}O_4P$; FW: 356.4; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-1371 NEW	(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) (1193697-61-8) $C_{26}H_{21}O_4P$; FW: 356.4; White to light-yellow powdr. Note: Sold in collaboration with Daicel for research purposes only.		100mg
15-3520	n-Octylphosphonic acid, min. 97% OPA (4724-48-5) $CH_3(CH_2)_7P(O)(OH)_2$; FW: 194.21; white to off-white powdr.; m.p. 102-103° Note: Long-Chain n-Alkylphosphonic Acid Kit component.		1g 5g
26-3575	1,2,3,4,5-Pentaphenyl-1'-(di-t-butylphosphino)ferrocene, 95% CTC-Q-PHOS (312959-24-3) $C_{48}H_{47}FeP$; FW: 710.71; pink powdr. Note: Sold in collaboration with Johnson Matthey for research purposes only. Patent Application No WO 02/11883.		100mg 500mg 2g 10g

Technical Notes:

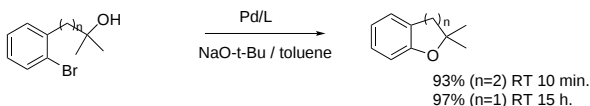
- Ligand used in the preparation of active Pd catalysts for C-C, C-N and C-O bond formation.
- Ligand used in Pd-catalyzed α -arylation of azlactones.
- Pd-catalyzed α -arylation of esters, amides and aldehydes.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



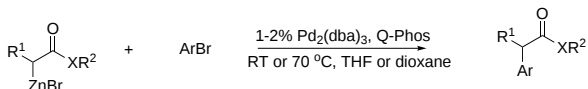
Tech. Note (3)
Ref. (3)

PHOSPHORUS - Ligands and Compounds

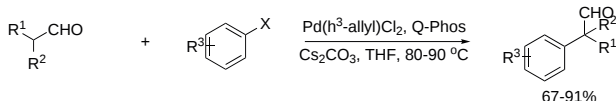
26-3575 1,2,3,4,5-Pentaphenyl-1'-(di-t-butylphosphino)ferrocene, 95% CTC-Q-PHOS (312959-24-3)
(continued)



Tech. Note (4)
Ref. (4)



Tech. Note (3)
Ref. (3)

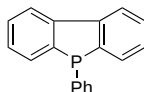


Tech. Note (4)
Ref. (4)

References:

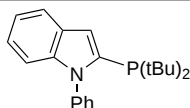
1. J. Org. Chem., **2002**, 67, 5553
2. Org. Lett., **2003**, 5, 1915
3. J. Am. Chem. Soc., **2003**, 125, 11176
4. Angew. Chem. Int. Ed., **2008**, 47, 2127

15-3525 5-Phenyl-5H-benzo[b]phosphindole, 99%
(1088-00-2)
C₁₈H₁₃P; FW: 260.27; off-white to beige solid



100mg
500mg

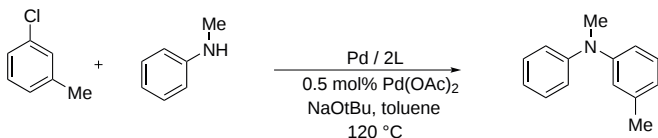
15-3550 N-Phenyl-2-(di-t-butylphosphino)indol, min. 98% [cataCXium® PlntB]
(740815-37-6)
C₂₂H₂₈NP; FW: 337.44;
white to yellow powdr.
air sensitive
Note: Sold in collaboration with
Solvias for research purposes only.
Patent Application pending. Solvias
cataCXium® Ligand Kit component.



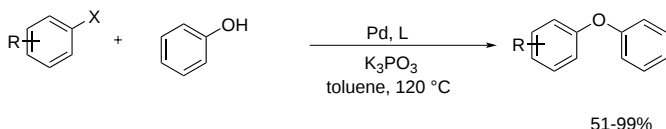
500mg
2g

Technical Notes:

1. Useful ligand for the Pd-catalyzed amination reaction.
2. Ligand used for the Pd-catalyzed arylation of phenols.
3. Useful ligand for the Suzuki-Miyaura coupling.
4. Ligand used for the Sonagashira reaction of aryl bromides.



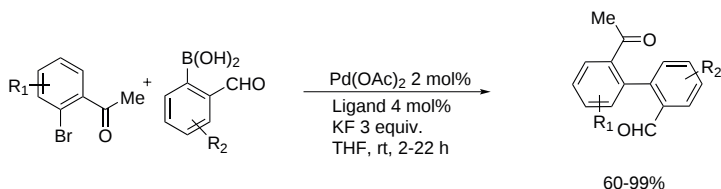
Tech. Note (1)
Ref. (1)



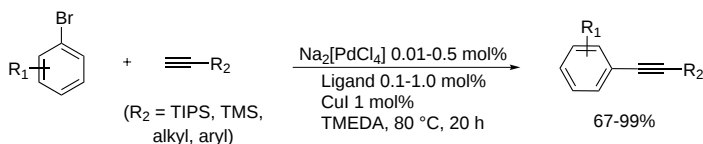
Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

15-3550 N-Phenyl-2-(di-t-butylphosphino)indol, min. 98% [cataCXium® PlntB] (740815-37-6)
(continued)



Tech. Note (3)
Ref. (3)

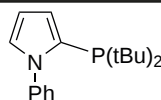


Tech. Note (4)
Ref. (4)

References:

1. *Chem. Eur J.* **2004**, *10*, 2983.
2. *Tetrahedron Lett.*, **2005**, *46*, 3237.
3. *J. Org. Chem.*, **2009**, *74*, 3948.
4. *Chem. Sus. Chem.*, **2008**, *1*, 91.

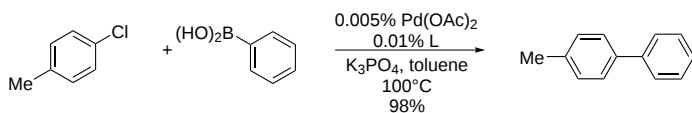
15-3600 N-Phenyl-2-(di-t-butylphosphino)pyrrole, **95+%** [cataCXium® PtB] (672937-61-0)
C₁₈H₂₆NP; FW: 287.38; white to yellow powdr.;
m.p. 51°
air sensitive
Note: Sold in collaboration with Solvias for research purposes only. Patent Application pending. Solvias cataCXium® Ligand Kit component.



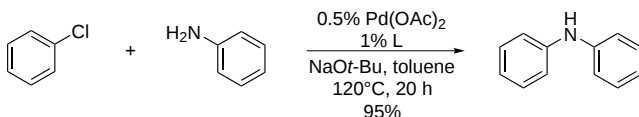
500mg
2g

Technical Notes:

1. Ligand for Suzuki reaction of aryl chlorides.
2. Ligand for Pd-catalyzed amination of aryl and heteroaryl chlorides.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

1. *Chem. Commun.*, **2004**, 38-39.
2. *Chem.-Eur. J.*, **2004**, *10*, 2983.

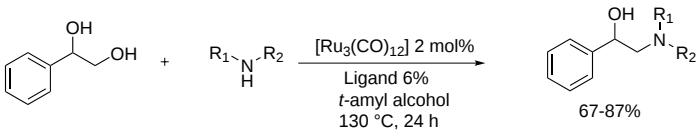
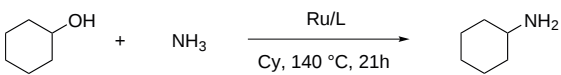
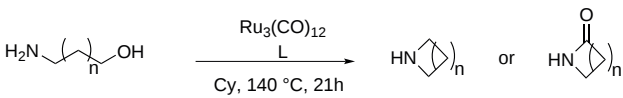
15-4150 Phenylidichlorophosphine, **97%** (644-97-3)
HAZ C₆H₅PCl₂; FW: 178.99; yellow liq.; m.p. -51°; b.p. 225°; f.p. >230°F;
d. 1.319 (20°)
air sensitive, moisture sensitive

50g
250g
1kg

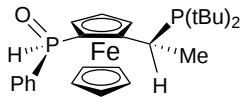
15-4155 Phenylidichlorophosphine, **99%** (644-97-3)
HAZ C₆H₅PCl₂; FW: 178.99; colorless to light yellow liq.; m.p. -51°; b.p. 225°;
f.p. >230°F; d. 1.319 (20°)
air sensitive, moisture sensitive

50g
250g

PHOSPHORUS - Ligands and Compounds

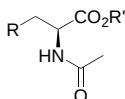
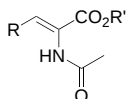
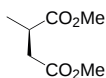
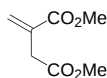
15-4158 HAZ	Phenyldichlorophosphine oxide, min. 94% (824-72-6) $C_6H_5P(O)Cl_2$; FW: 194.99; colorless to light yellow liq.; m.p. 3°; b.p. 258°; f.p. 400°F; d. 1.394 (25°) <i>air sensitive, moisture sensitive</i>	50g 250g
15-3605	N-Phenyl-2-(dicyclohexylphosphino) indol, min. 95% [cataCXium® PlnCy] (740815-36-5) $C_{26}H_{32}NP$; FW: 389.51; white to yellow powdr. <i>air sensitive</i> Note: Sold in collaboration with Solvias for research purposes only. Patent Application pending. Solvias cataCXium® Ligand Kit component.	500mg 2g
Technical Note: 1. See 15-3550.		
15-3610	N-Phenyl-2-(dicyclohexylphosphino) pyrrole, 90% [cataCXium® PCy] (672937-60-9) $C_{22}H_{30}NP$; FW: 339.45; white to yellow powdr.; m.p. 92° <i>air sensitive</i> Note: Contains ca. 10% of the regioisomer, N-(2-(dicyclohexylphosphino-phenyl)pyrrole. Sold in collaboration with Solvias for research purposes only. Patent Application pending. Solvias cataCXium® Ligand Kit component.	500mg 2g
Technical Notes: 1. Useful ligand for the Ru-catalyzed amination of diols. 2. Direct amination of secondary alcohols with ammonia. 3. Amino-alcohol cyclization to lactams or cyclic amines.		
		Tech. Note (1) Ref. (1)
		Tech. Note (2) Ref. (2,3)
		Tech. Note (3) Ref. (4)
References: 1. <i>Chem. Sus. Chem.</i> , 2009 , 2, 551. 2. <i>Angew. Chem. Int. Ed.</i> , 2010 , 49, 8130. 3. <i>Angew. Chem. Int. Ed.</i> , 2010 , 49, 8126. 4. <i>Catal. Sci. Technol.</i> , 2014 , 4, 47.		
15-4250	Phenyldimethoxyphosphine, 98% (2946-61-4) $(C_6H_5)(CH_3O)_2P$; FW: 170.15; colorless liq.; b.p. 77-79°/7 mm; f.p. >230°F; d. 1.072 <i>air sensitive, moisture sensitive</i>	1g 5g

PHOSPHORUS - Ligands and Compounds

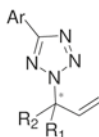
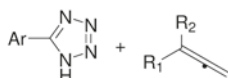
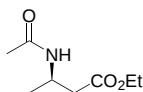
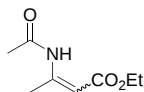
15-4400 amp HAZ 	Phenylphosphine, 99% (638-21-1) C ₆ H ₅ PH ₂ ; FW: 110.10; colorless liq.; b.p. 160°; f.p. 165°F; d. 1.001 <i>pyrophoric, STENCH</i>	2g 10g
15-4402 HAZ 	Phenylphosphine, 99% (Sure/Seal™ bottle) (638-21-1) C ₆ H ₅ PH ₂ ; FW: 110.10; colorless liq.; b.p. 160°; f.p. 165°F; d. 1.001 <i>pyrophoric, STENCH</i>	25g
15-4403 HAZ	Phenylphosphine, 99% (10 wt% in hexanes) (638-21-1) C ₆ H ₅ PH ₂ ; FW: 110.10; colorless liq. <i>air sensitive, STENCH</i>	20g 100g
93-1536 HAZ	Phenylphosphinic acid, 99% (1779-48-2) C ₆ H ₅ P(O)(OH)H; FW: 142.09; white xtl.; m.p. 83-85°	100g 500g
26-1268	(R,S(p), R(SPO)-1-Phenylphosphinoyl)-2-[1-(di-t-butylphosphino)ethyl]ferrocene, min. 97% JoSPOphos (1221746-66-2) C ₂₆ H ₃₈ FeOP ₂ ; FW: 482.36; orange powdr. (store cold) Note: Sold in collaboration with Solvias for research purposes only.	 100mg 500mg 2g 10g

Technical Notes:

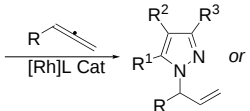
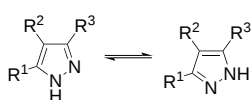
- Ligands used for the rhodium-catalyzed asymmetric hydrogenation of functionalized alkenes, α- and β-ketoesters.
- Ligand for rhodium-catalyzed enantioselective formation of tertiary and quaternary allylic C–N bonds via allylation of tetrazoles.
- Ligand for rhodium-catalyzed highly regio- and enantioselective addition of pyrazoles to terminal allenes.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3,4)

References:

- Angew. Chem. Int. Ed., **2010**, 49, 6873.
- Chem. Commun., **2015**, 51, 10861.
- Angew. Chem. Int. Ed., **2015**, 54, 7149.
- Chem. Eur. J., **2016**, 22, 6547.

PHOSPHORUS - Ligands and Compounds

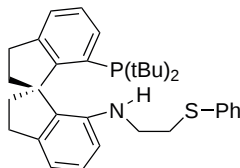
26-1269	(S, R(p), S(SPO)-1-Phenylphosphinoyl)-2-[1-(di-t-butylphosphino)ethyl]ferrocene, min. 97% JoSPOphos (1221746-56-0)	100mg
	C ₂₆ H ₃₆ FeOP ₂ ; FW: 482.36; orange powdr.	500mg
	(store cold)	2g
	Note: Sold in collaboration with Solvias for research purposes only.	10g

Technical Note:

- See 26-1268 (page 250)

93-1537 HAZ	Phenylphosphonic acid, 98% (1571-33-1)	50g
	(C ₆ H ₅)P(O)(OH) ₂ ; FW: 158.09; white xtl.; m.p. 163-166°	250g 1kg

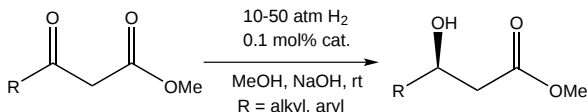
15-1605 NEW	(R)-(+)-7-[N-(2-Phenylthio)ethyl-amino]-7'-[bis(3,5-di-t-butylphenyl) phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobindane, 97+% (>99% ee) [(R)-DTB-SpiroSAP-Ph] (1809609-38-8)	25mg 100mg
	C ₅₃ H ₆₈ NPS; FW: 780.14; off-white solid; m.p. 58-60° air sensitive	



This technical note is for the iridium complex 77-2510. This is an analogous ligand included in the reference below.

Technical Note:

- Catalyst used for the asymmetric hydrogenation of β-alkyl- β-ketoesters.

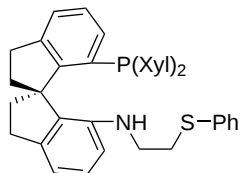


Tech. Note (1)
Ref. (1)

References:

- Angew. Chem. Int. Ed., 2015, 54, 8791

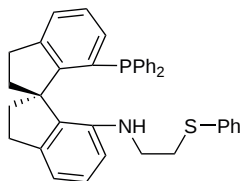
15-1645 NEW	(R)-(+)-7-[N-(2-Phenylthio)ethyl-amino]-7'-[bis(3,5-dimethylphenyl) phosphino]-2,2',3,3'-tetrahydro-1,1'-spirobindane, 97+% (>99% ee) [(R)-Xyl-SpiroSAP-Ph] (1809609-39-9)	25mg 100mg
	C ₄₁ H ₄₂ NPS; FW: 611.82; off-white solid; m.p. 58-60° air sensitive	



Technical Note:

- See 15-1605 (page 251)

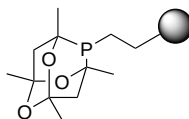
15-1643 NEW	(R)-(+)-7-[N-(2-Phenylthio)ethyl-amino]-7'-[diphenylphosphino]-2,2',3,3'-tetrahydro-1,1'-spirobindane, 97+% (>99% ee) [(R)-Ph-SpiroSAP-Ph] (1809609-40-2)	25mg 100mg
	C ₃₇ H ₃₄ NPS; FW: 555.71; off-white solid; m.p. 55-58° air sensitive	



Technical Note:

- See 15-1605 (page 251)

15-4510	Phosphaadamantane ethyl Silica (free phosphine ligand) (PhosphonicS PAR)	500mg
	white solid	2g
	Note: Sold in collaboration with PhosphonicS Ltd. for research purposes only.	



Particle size range: 60-200 microns

Functional group loading : 0.4 to 0.8 mmol/g

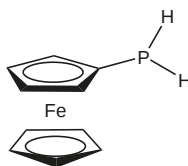
Technical Note:

- Supported, free phosphine used in the preparation of immobilized phosphine metal complexes.

PHOSPHORUS - Ligands and Compounds

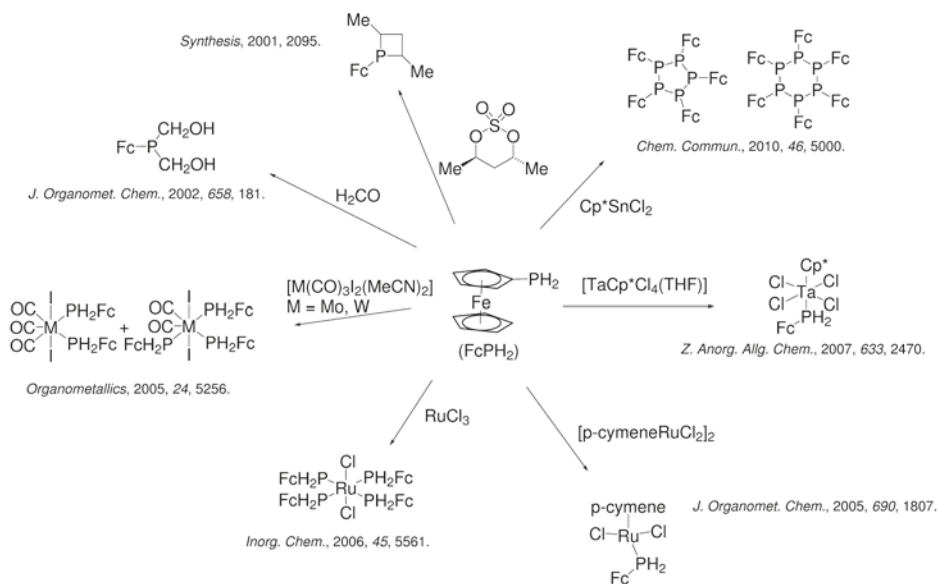
26-3620 Phosphinoferrocene, 98% (83528-85-2)
 $C_{10}H_{11}FeP$; FW: 218.01; red-brown solid
air sensitive

1g
 5g



Technical Note:

1. Ferrocene organophosphorus building block.

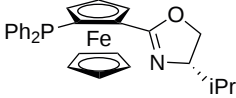


References:

1. See above.

15-4530 HAZ	Phosphonitrilic chloride trimer, 98.5% (940-71-6) ($PNCl_2$) ₃ ; FW: 347.66; white xtl.; m.p. 128.8°; b.p. 127°/12 mm; d. 1.98 <i>moisture sensitive</i>	10g 50g
93-1541 HAZ	Phosphoric acid (ACS), 85% (7664-38-2) H_3PO_4 ; FW: 98.00; colorless liq.; d. 1.685	1kg
93-1550 HAZ	Phosphorus(III) bromide, 97+% (7789-60-8) PBr_3 ; FW: 270.70; colorless to pale yellow liq.; m.p. -40°; b.p. 172.9°; d. 2.852 (15°) <i>air sensitive, moisture sensitive</i>	100g 500g
93-1587 HAZ 	Phosphorus(III) chloride, 98+% (7719-12-2) PCl_3 ; FW: 137.33; colorless liq.; m.p. -111.8°; b.p. 76°; d. 1.574 <i>moisture sensitive</i>	250g
93-1588 amp HAZ 	Phosphorus(III) chloride (99.998%-P) PURATREM (7719-12-2) PCl_3 ; FW: 137.33; m.p. -111.8°; b.p. 76°; d. 1.574 <i>moisture sensitive</i>	10g 50g

PHOSPHORUS - Ligands and Compounds

93-1545 HAZ	Phosphorus(V) chloride, 98% (10026-13-8) PCl ₅ ; FW: 208.24; white to pale yellow xtl.; m.p. 166.8° subl. <i>moisture sensitive</i>	250g 1kg
93-1548 HAZ	Phosphorus(V) oxide, 98+% (ACS) (1314-56-3) P ₂ O ₅ ; FW: 141.95; white powdr.; m.p. 580-585°; b.p. 300° subl.; d. 2.39 <i>hygroscopic</i>	500g 4 x 500g
93-1592 HAZ	Phosphorus(V) oxide (99.99%-P) PURATREM (1314-56-3) P ₂ O ₅ ; FW: 141.95; white powdr.; m.p. 580-585°; b.p. 300° subl.; d. 2.39 <i>hygroscopic</i>	50g 250g
93-1586 amp HAZ	Phosphorus oxybromide, 99% (7789-59-5) POBr ₃ ; FW: 286.73; colorless to light yellow xtl.; m.p. 56°; b.p. 193°; d. 2.822 <i>moisture sensitive</i>	5g 25g 100g
93-1543 HAZ 	Phosphorus oxychloride, 98+% (10025-87-3) POCl ₃ ; FW: 153.35; colorless liq.; m.p. 2°; b.p. 105.3°; d. 1.675 <i>moisture sensitive</i>	250g 1kg
97-8875 amp HAZ 	Phosphorus oxychloride, elec. gr. (99.999%-P) PURATREM (10025-87-3) POCl ₃ ; FW: 153.35; colorless liq.; m.p. 2°; b.p. 105.3°; d. 1.675 <i>moisture sensitive</i>	25g 100g
93-1552 HAZ	Polyphosphoric acid (83% P₂O₅) (8017-16-1) H ₃ PO ₄ ·P ₂ O ₅ ; FW: 239.95; viscous liq. <i>hygroscopic</i>	250g 1kg
19-2610	Potassium di-t-butylphosphate, min. 91% (contains <5% water) (33494-80-3) K[OP(O)(OC ₄ H ₉) ₂]; FW: 248.30; white powdr.	500mg 2g
15-4581 amp HAZ	n-Propyldichlorophosphine, min. 98% (15573-31-6) n-C ₃ H ₇ PCl ₂ ; FW: 144.97; colorless liq.; b.p. 133°; d. 1.118 <i>air sensitive, moisture sensitive</i>	2g 10g
26-4011	(R,R)-[2-(4'-i-Propyloxazolin-2'-yl)ferrocenyl]diphenylphosphine, min. 97% (541540-70-9) C ₂₈ H ₂₈ FeNOP; FW: 481.35; orange solid <i>air sensitive</i>	 100mg 500mg
26-4010	(S,S)-[2-(4'-i-Propyloxazolin-2'-yl)ferrocenyl]diphenylphosphine, min. 97% (163169-29-7) C ₂₈ H ₂₈ FeNOP; FW: 481.35; orange solid <i>air sensitive</i>	100mg 500mg
93-1579 HAZ	Tetra-n-butylphosphonium bromide, 98% (3115-68-2) (C ₄ H ₉) ₄ P·Br; FW: 339.35; white xtl.; m.p. 100-103° <i>hygroscopic</i>	25g 100g
15-1318 HAZ	Tetrabutylphosphonium chloride (80-82 wt% solution in water) (2304-30-5) C ₁₆ H ₃₆ ClP; FW: 294.88; colorless to pale-yellow liq.	5g 25g
15-5145	n-Tetradecylphosphonic acid, min. 97% TDPA (4671-75-4) CH ₃ (CH ₂) ₁₃ P(O)(OH) ₂ ; FW: 278.37; white to off-white powdr.; m.p. 96-98° Note: Long-Chain n-Alkylphosphonic Acid Kit component.	1g 5g 25g

PHOSPHORUS - Ligands and Compounds

15-5162

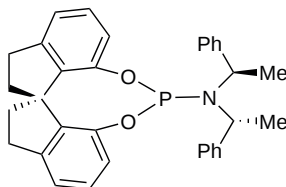
(11aR)-(+)-10,11,12,13-Tetrahydroindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min.

98% (R)-SIPHOS-PE (500997-69-3)

C₃₃H₃₂NO₂P; FW: 505.59; white solid; m.p. 98-100°

moisture sensitive

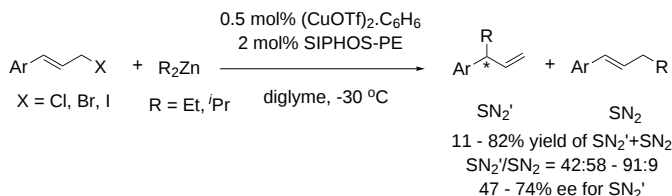
Note: Spiro Monophosphite and Monophosphoramidite Ligand kit component.



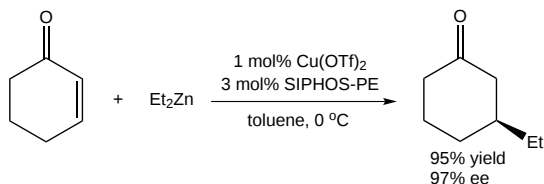
100mg
500mg

Technical Notes:

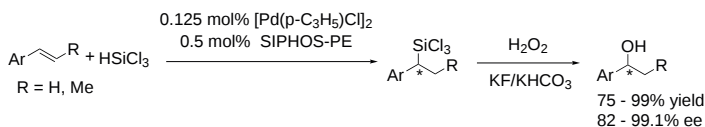
1. Chiral ligands for copper-catalyzed asymmetric allylic alkylation with dialkylzincs.
2. Chiral ligands for copper-catalyzed asymmetric conjugate addition of diethylzinc to enones.
3. Chiral ligands for palladium-catalyzed asymmetric hydrosilylation of styrenes
4. Chiral ligands for copper-catalyzed asymmetric ring-opening of oxabicyclic alkenes with Grignard reagents.
5. Chiral ligands for nickel-catalyzed asymmetric hydrovinylation of α -alkyl vinylarenes.
6. Chiral ligands for iridium-catalyzed asymmetric hydrogenation of cyclic enamines.
7. Chiral ligands for iridium-catalyzed asymmetric hydrogenation of cyclic imines.
8. Chiral ligands for gold-catalyzed asymmetric [2 + 2] cycloaddition reaction.
9. Chiral ligands for rhodium-catalyzed asymmetric hydroacylation of salicylaldehydes to homoallylic sulfides
10. Chiral ligands for palladium-catalyzed asymmetric carbaoamination reactions.



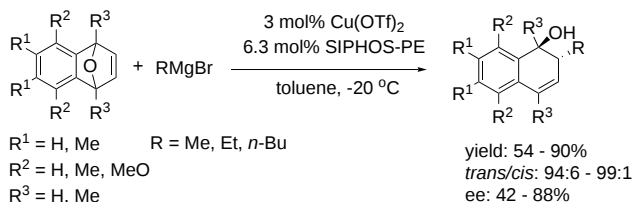
Tech. Note (1)
Ref. (1)



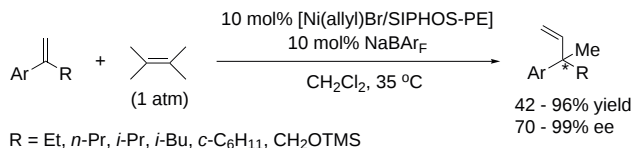
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



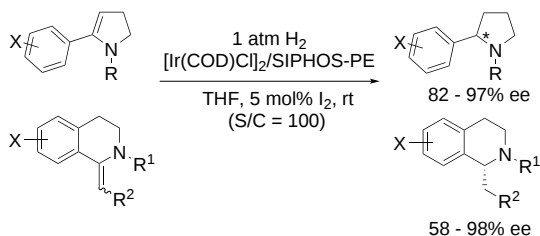
Tech. Note (4)
Ref. (4)



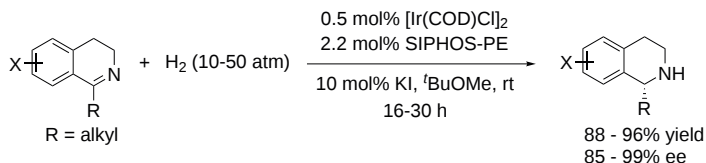
Tech. Note (5)
Ref. (5,6)

PHOSPHORUS - Ligands and Compounds

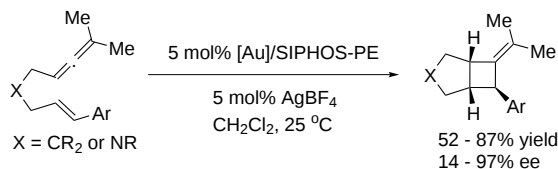
15-5162 (continued) (11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (R)-SIPHOS-PE (500997-69-3)



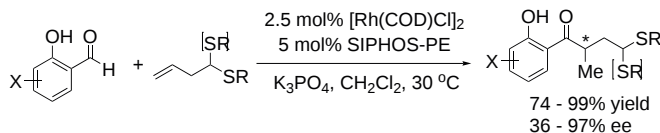
Tech. Note (6)
Ref. (7,8)



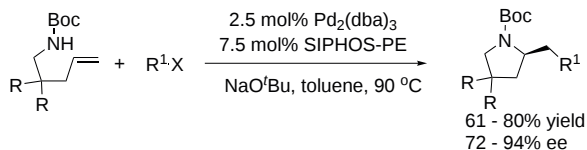
Tech. Note (7)
Ref. (9)



Tech. Note (8)
Ref. (10)



Tech. Note (9)
Ref. (11)



Tech. Note (10)
Ref. (12,13)

References:

1. *Tetrahedron: Asymmetry* **2003**, 14, 3867.
2. *J. Org. Chem.* **2003**, 68, 1582.
3. *Tetrahedron: Asymmetry* **2004**, 15, 2231
4. *J. Org. Chem.* **2005**, 70, 3734.
5. *J. Am. Chem. Soc.* **2006**, 128, 2780.
6. *Sci. China Chem.* **2010**, 53, 1899.
7. *J. Am. Chem. Soc.* **2009**, 131, 1366.
8. *Adv. Synth. Catal.* **2010**, 351, 3243.
9. *ACS Catal.* **2012**, 2, 561.
10. *J. Am. Chem. Soc.* **2011**, 133, 5500.
11. *J. Am. Chem. Soc.* **2010**, 132, 16330.
12. *J. Am. Chem. Soc.* **2010**, 132, 12157.
13. *Org. Lett.* **2011**, 13, 2932.

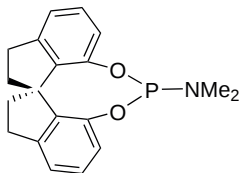
PHOSPHORUS - Ligands and Compounds

15-5163	(11aS)-(-)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-bis[(R)-1-phenylethyl]amine, min. 98% (S)-SIPHOS-PE (500997-70-6)	100mg 500mg
	$C_{33}H_{32}NO_2P$; FW: 505.59; white solid; m.p. 99-101° <i>moisture sensitive</i> Note: Spiro Monophosphite and Monophosphoramidite Ligand Kit component.	

Technical Note:

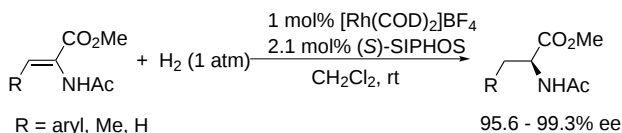
1. See 15-5162 (page 254)

15-5150	(11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-dimethylamine, min. 98% (R)-SIPHOS (443965-14-8)	100mg 500mg
	$C_{19}H_{20}NO_2P$; FW: 325.34; white solid; m.p. 95-96° <i>moisture sensitive</i> Note: Spiro Monophosphite and Monophosphoramidite Ligand Kit component.	

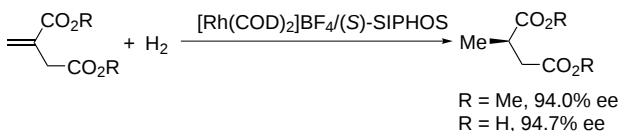


Technical Notes:

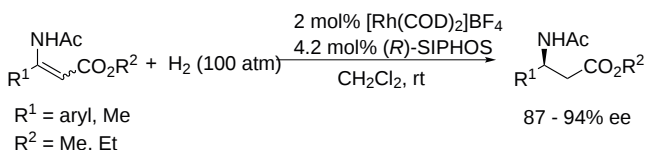
1. Chiral ligands for the rhodium-catalyzed asymmetric hydrogenation of α -dehydroamino esters.
2. Chiral ligands for the rhodium-catalyzed asymmetric hydrogenation of itaconic acid derivatives.
3. Chiral ligands for rhodium-catalyzed asymmetric hydrogenation of β -dehydroaminoesters.
4. Chiral ligands for rhodium-catalyzed asymmetric hydrogenation of enamides.
5. Chiral ligands for rhodium-catalyzed asymmetric Pauson-Khand reaction.
6. Chiral ligands for palladium-catalyzed asymmetric umpolung allylation of aldehydes.



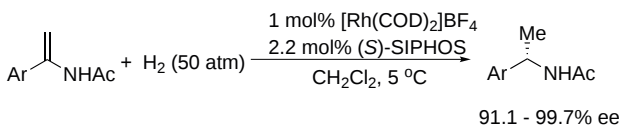
Tech. Note (1)
Ref. (1)



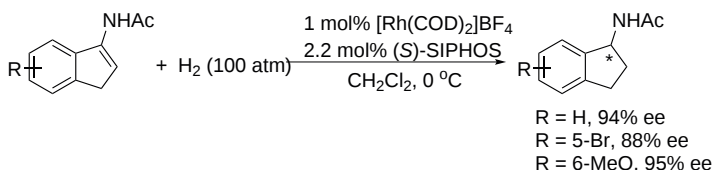
Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)



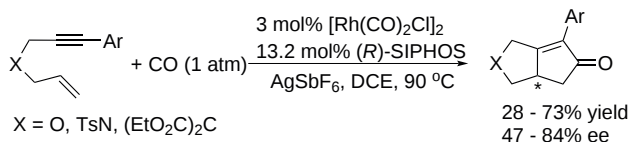
Tech. Note (4)
Ref. (3)



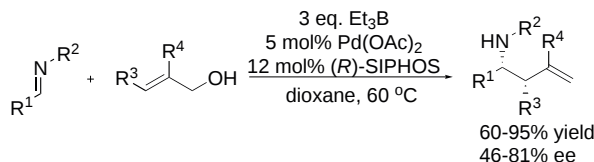
Tech. Note (4)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

15-5150 (11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-dimethylamine, min. 98% (R)-SIPHOS (443965-14-8)



Tech. Note (5)
Ref. (4)



Tech. Note (6)
Ref. (5)

References:

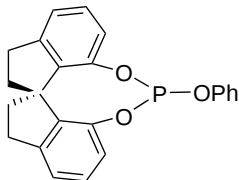
1. *Chem. Commun.* **2002**, 480.
2. *J. Org. Chem.* **2004**, 69, 4648.
3. *Angew. Chem., Int. Ed.* **2002**, 41, 2348.
4. *Adv. Synth. Catal.* **2005**, 347, 759.
5. *Tetrahedron: Asymm.* **2010**, 21, 1216.

15-5151	(11aS)-(-)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-dimethylamine, min. 98% (S)-SIPHOS (443965-10-4) C ₁₉ H ₂₀ NO ₂ P; FW: 325.34; white solid; m.p. 95-96° moisture sensitive Note: Spiro Monophosphite and Monophosphoramidite Ligand Kit component.	100mg 500mg
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Technical Note:

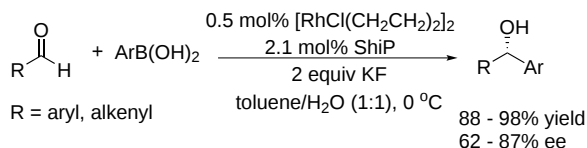
1. See 15-5150 (page 256)

15-5156	(11aR)-(+)-10,11,12,13-Tetrahydrodiindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-phenoxy, min. 98% (R)-ShiP (656233-53-3) C ₂₃ H ₁₉ O ₃ P; FW: 374.37; white solid; m.p. 104-106° moisture sensitive Note: Spiro Monophosphite and Monophosphoramidite Ligand Kit component.	100mg 500mg
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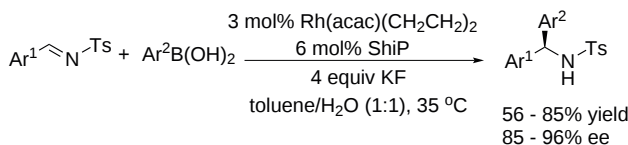


Technical Notes:

1. Chiral ligands for rhodium-catalyzed arylation of aldehydes with arylboronic acids.
2. Chiral ligands for rhodium-catalyzed arylation of imines with arylboronic acids.
3. Chiral ligands for rhodium-catalyzed arylation of α-ketoesters with arylboronic acids.
4. Chiral ligands for palladium-catalyzed asymmetric umpolung allylation of aldehydes.
5. Chiral ligands for rhodium-catalyzed asymmetric hydrogenation of (Z)-β-arylenamides.



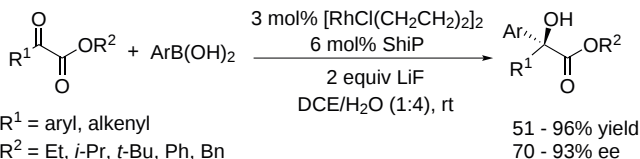
Tech. Note (1)
Ref. (1)



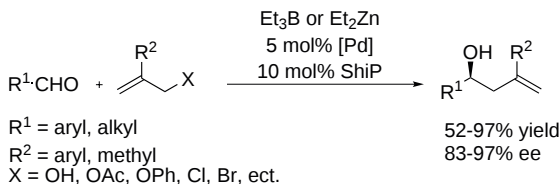
Tech. Note (2)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

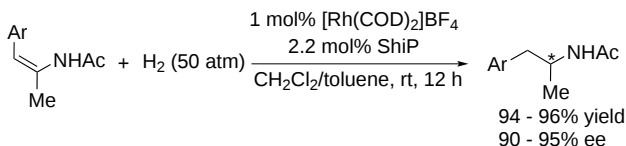
15-5156 (11aR)-(+)-10,11,12,13-Tetrahydrodiinden[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-phenoxy, min. 98% (R)-ShiP (656233-53-3)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

References:

1. *Org. Lett.* **2006**, 8, 1479.
2. *Org. Lett.* **2006**, 8, 2567.
3. *Angew. Chem. Int. Ed.* **2008**, 47, 4351.
4. *Chem. Sci.* **2011**, 2, 1135.
5. *Tetrahedron* **2012**, 68, 7685.

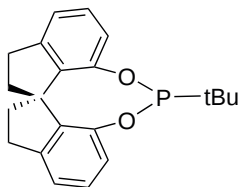
15-5157 (11aS)-(-)-10,11,12,13-Tetrahydrodiinden[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin-5-phenoxy, min. 98% (S)-ShiP (885701-71-3)
 $\text{C}_{23}\text{H}_{19}\text{O}_3\text{P}$; FW: 374.37; white solid; m.p. 102-103°
 moisture sensitive
 Note: Spiro Monophosphite and Monophosphoramidite Ligand Kit component.

100mg
500mg

Technical Note:

1. See 15-5156 (page 257)

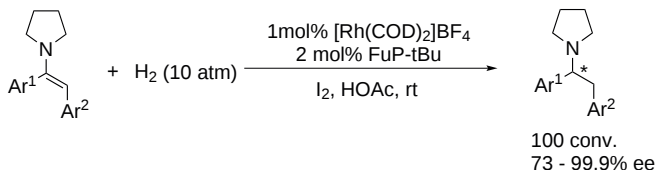
15-5130 (11aR)-(+)-10,11,12,13-Tetrahydro-5-(1,1-dimethylethyl)diinden[7,1-de,1',7'-fg][1.3.2] dioxaphosphocin, 97% (R)-FuP-tBu
 $\text{C}_{21}\text{H}_{23}\text{O}_2\text{P}$; FW: 338.38; white solid
 moisture sensitive



25mg
100mg

Technical Note:

1. Chiral ligand for the rhodium-catalyzed, asymmetric hydrogenation of enamines.



Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.*, **2006**, 128, 11774.

PHOSPHORUS - Ligands and Compounds

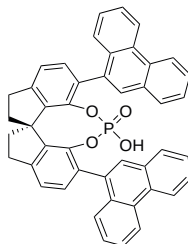
15-5131 (11aS)-(-)-10,11,12,13-Tetrahydro-5-(1,1-dimethylethyl)diinden-
no[7,1-de,1',7'-fg][1.3.2] dioxaphosphocin, 97% (S)-FuP-tBu
(912457-08-0)
C₂₁H₂₃O₂P; FW: 338.38; white solid
moisture sensitive

25mg
100mg

Technical Note:

1. See 15-5130 (page 258)

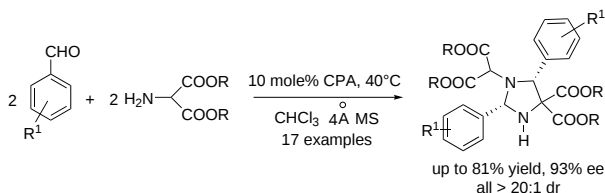
15-1363 (11aR)-10,11,12,13-Tetrahydro-5-hydroxy-
3,7-di-9-phenanthrenyl-5-oxide-diinde-
NEW no[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin,
min. 98% (1372719-93-1)
C₄₅H₃₁O₃P; FW: 666.70;
white to light-yellow powdr.
Note: Sold in collaboration with Daicel for
research purposes only.



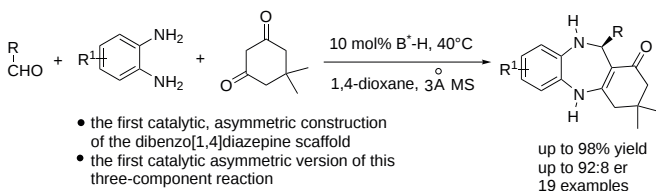
25mg
100mg

Technical Notes:

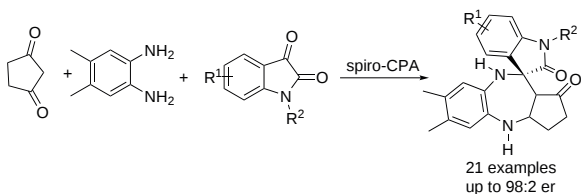
1. Catalytic asymmetric homo-1,3-dipolar cycloadditions of azomethine ylides: diastereo and enantioselective synthesis of imidazolidines.
2. Enantioselective construction of the biologically significant dibenzo[1,4]diazepine scaffold via organocatalytic asymmetric three-component reactions.
3. Enantioselective construction of the biologically important cyclopenta[1,4]diazepine framework enabled by asymmetric catalysis by chiral spiro-phosphoric acid.
4. Triply hydrogen-bond-directed enantioselective assembly of pyrrolobenzo-1,4-diazine skeletons with quaternary stereocenters.



Tech. Note (1)
Ref. (1)



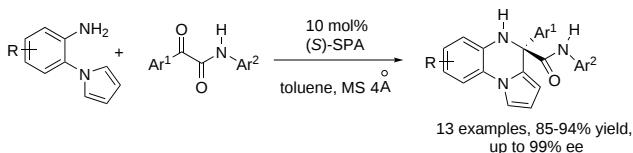
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

PHOSPHORUS - Ligands and Compounds

15-1363 (11aR)-10,11,12,13-Tetrahydro-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1372719-93-1)



Tech. Note (4)
Ref. (4)

References:

1. *Tetrahedron Asymmetry*, **2014**, 25, 617.
2. *Adv. Synth. Catal.*, **2009**, 356, 2009.
3. *Eur. J. Org. Chem.*, **2015**, 2015, 7926.
4. *Chem-Eur. J.*, **2015**, 21, 9039.

15-1364

NEW

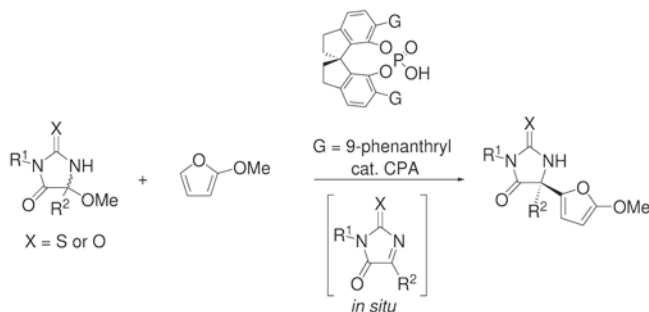
(11aS)-10,11,12,13-Tetrahydro-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, min. 98% (1585988-92-6)
C₄₆H₃₁O₄P; FW: 666.70; white to light-yellow powdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg

100mg

Technical Note:

1. Chiral Bronsted, acid-catalyzed, enantioselective Friedel-Crafts reaction of 2-methoxyfuran with aliphatic ketimines generated in situ.



Tech. Note (1)
Ref. (1)

References:

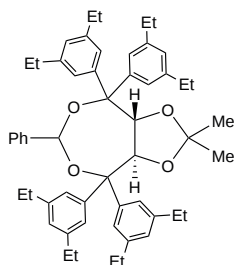
1. *Chem. Sci.*, **2016**, 7, 1057.

15-1517

(3aR,8aR)-(-)-4,4,8,8-Tetrakis(3,5-diethylphenyl) tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo [4,5-e] dioxaphosphepin (1187446-93-0)
C₅₃H₆₅O₄P; FW: 797.06; off-white powdr.

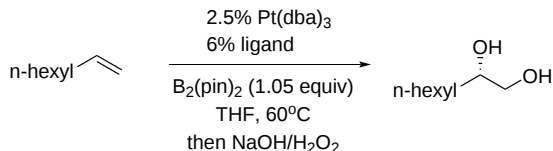
100mg

500mg



Technical Note:

1. Chiral ligand used in the platinum-catalyzed, enantioselective diboration of terminal alkenes.



Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.* **2009**, 131, 13210.

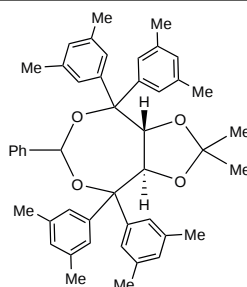
PHOSPHORUS - Ligands and Compounds

15-1518	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-diethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin	100mg 500mg
	C ₅₃ H ₆₅ O ₄ P; FW: 797.06; off-white powder.	

Technical Note:

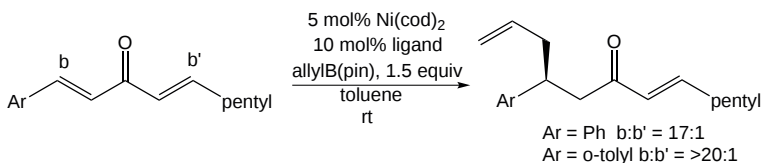
1. See 15-1518 (page 261)

15-1511	(3aR,8aR)-(-)-4,4,8,8-Tetrakis (3,5-dimethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin (1019840-96-0)	100mg 500mg
	C ₄₅ H ₄₉ O ₄ P; FW: 684.84; off-white solid	

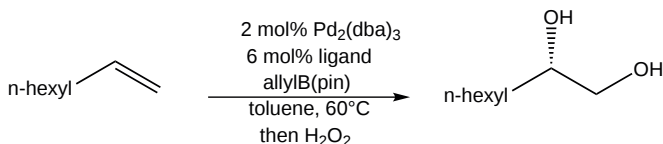


Technical Notes:

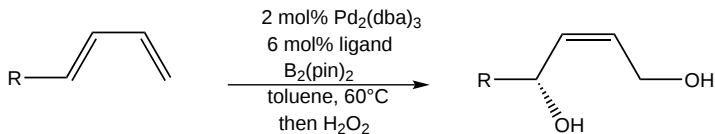
1. Chiral ligand used in the nickel-catalyzed, enantioselective, conjugate allylation of activated enones.
2. Chiral ligand used in the palladium-catalyzed, enantioselective diboration of terminal alkenes.
3. Chiral ligand used in the palladium-catalyzed, asymmetric, 1,4-dihydroxylation of 1,3-dienes via catalytic enantioselective diboration.
4. Chiral ligand used in the palladium-catalyzed diboration of N-silylated imines.



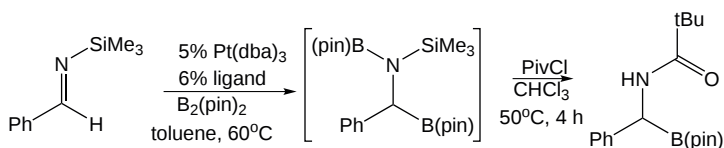
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



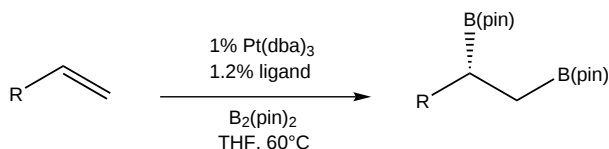
Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

PHOSPHORUS - Ligands and Compounds

15-1511 (3aR,8aR)-(-)-4,4,8,8-Tetrakis (3,5-dimethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin (1019840-96-0)



Tech. Note (2)
Ref. (5)

References:

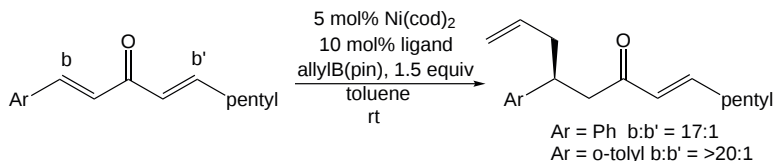
1. *J. Am. Chem. Soc.*, **2008**, 130, 4978.
2. *J. Am. Chem. Soc.*, **2009**, 131, 13210.
3. *J. Am. Chem. Soc.*, **2009**, 131, 9134.
4. *J. Am. Chem. Soc.*, **2013**, 135, 9252.
5. *Nature*, **2014**, 505, 386.

15-1512 (3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-dimethylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-e]dioxaphosphepin (1169835-86-2)
 $\text{C}_{45}\text{H}_{49}\text{O}_4\text{P}$; FW: 684.84; off-white solid

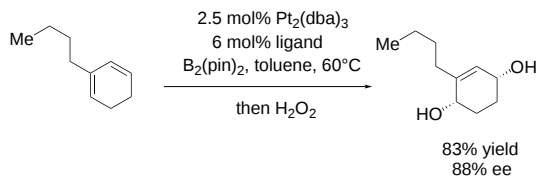
100mg
500mg

Technical Notes:

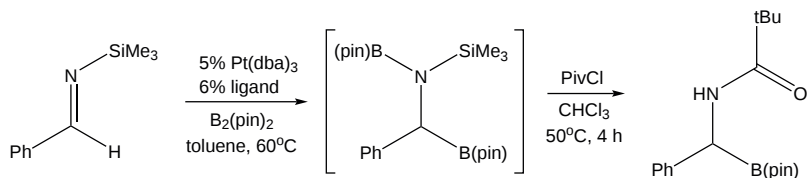
1. Chiral ligand used in the nickel-catalyzed, enantioselective, conjugate allylation of activated enones.
2. Chiral ligand used in the platinum-catalyzed, asymmetric, 1,4-dihydroxylation of 1,3-dienes via catalytic enantioselective diboration.
3. Chiral ligand used in the platinum-catalyzed, asymmetric addition of $\text{B}_2(\text{pin})_2$ to N-silyl imines for the synthesis of α -amino boronates.
4. Asymmetric 1,4-dihydroxylation of 1,3-dienes by catalytic enantioselective diboration.



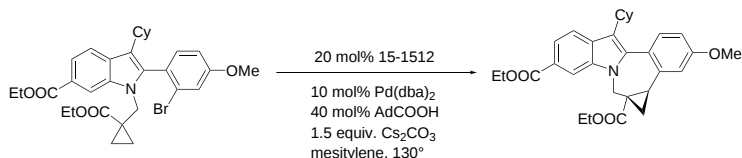
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

References:

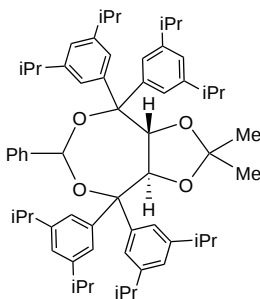
1. *J. Am. Chem. Soc.*, **2008**, 130, 4978.
2. *J. Am. Chem. Soc.*, **2009**, 131, 9134.
3. *J. Am. Chem. Soc.*, **2013**, 135, 9252.
4. *Chem. Sci.*, **2015**, 6, 5164.

PHOSPHORUS - Ligands and Compounds

15-1513

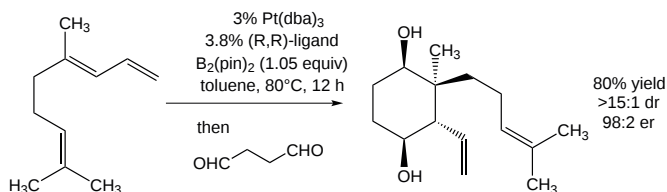
(3aR,8aR)-(-)-4,4,8,8-Tetrakis
(3,5-di-*i*-propylphenyl)tetrahy-
dro-2,2-dimethyl-6-phenyl-1,3-di-
oxolo[4,5-*e*]dioxaphosphepin
(1361146-90-8)
C₆₁H₈₁O₄P; FW: 909.27; off-white
powdr.

100mg
500mg

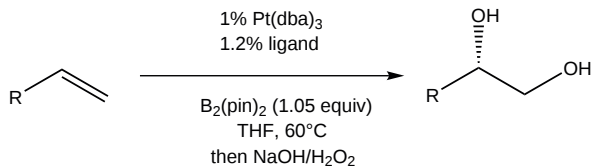


Technical Notes:

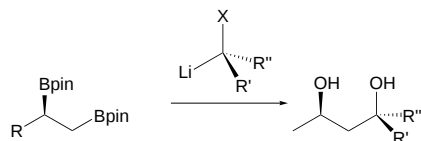
1. Chiral ligand used in a platinum-catalyzed, enantioselective, terpene construction.
2. Chiral ligand used in a platinum-catalyzed, diboration of aliphatic 1-alkenes.
3. Regio- and stereoselective homologation of 1,2-bis(boronic esters): stereocontrolled synthesis of 1,3-diols.
4. Synthesis of β -lactams by palladium(0)-catalyzed C(sp³)-H carbamoylation.



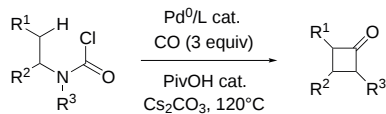
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

References:

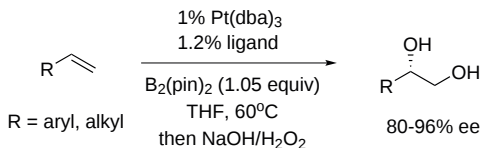
1. *J. Am. Chem. Soc.*, **2013**, 135, 2501.
2. *J. Am. Chem. Soc.*, **2013**, 135, 11222.
3. *Angew. Chem. Int. Ed.*, **2016**, 55, 14663.
4. *Angew. Chem. Int. Ed.*, **2017**, 56, 7218.

PHOSPHORUS - Ligands and Compounds

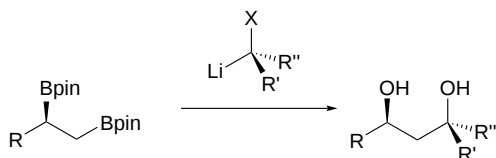
15-1514	(3aS,8aS)-(+)-4,4,8,8-Tetrakis(3,5-di-<i>i</i>-propylphenyl)tetrahydro-2,2-dimethyl-6-phenyl-1,3-dioxolo[4,5-<i>e</i>]dioxaphosphepin (1422371-27-4) $C_{61}H_{81}O_4P$; FW: 909.27; off-white powdr.	100mg 500mg
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Technical Notes:

- Chiral ligand for the platinum-catalyzed enantioselective diboration of monosubstituted alkenes.
- Regio- and stereoselective homologation of 1,2-bis(boronic esters): stereocontrolled synthesis of 1,3-diols.



Tech. Note (1)
Ref. (1)



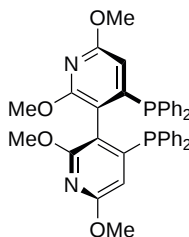
Tech. Note (2)
Ref. (2)

References:

- J. Am. Chem. Soc.* **2013**, 135, 11222.
- Angew. Chem.Int. Ed.*, **2016**, 55, 14663.

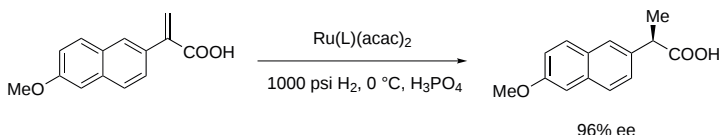
15-5201	(S)-(-)-2,2',6,6'-Tetramethoxy-4,4'-bis(diphenylphosphino)-3,3'-bipyridine, min. 95% CTH-(S)-P-Phos (362524-23-0) $C_{38}H_{34}N_2O_4P_2$; FW: 644.64; white to pale yellow powdr. Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent Application No US Patent 5 886 182, 1999 and patents arising therefrom.	100mg 500mg
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15-5200	(R)-(+)-2,2',6,6'-Tetramethoxy-4,4'-bis(diphenylphosphino)-3,3'-bipyridine, min. 97% CTH-(R)-P-Phos (221012-82-4) $C_{38}H_{34}N_2O_4P_2$; FW: 644.64; white to pale yellow powdr. Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent Application No US Patent 5 886 182, 1999 and patents arising therefrom.	100mg 500mg
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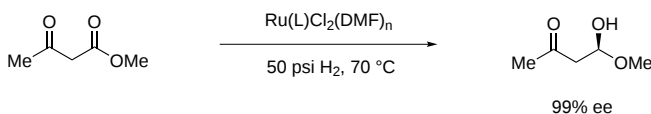


Technical Notes:

- New class of highly effective chiral dipyridylphosphine ligands used in the asymmetric hydrogenation of 2-arylacrylic acids, β -ketoesters, aryl ketones, and α -dehydroamino acids.
- Ligand used in the Pd-catalyzed asymmetric bis-alkoxycarbonylation of styrene.



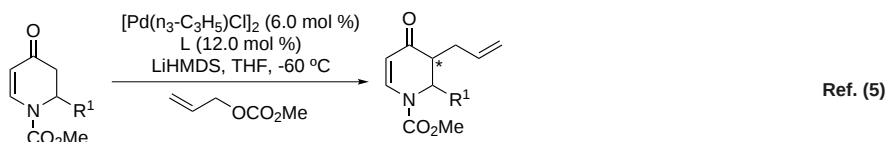
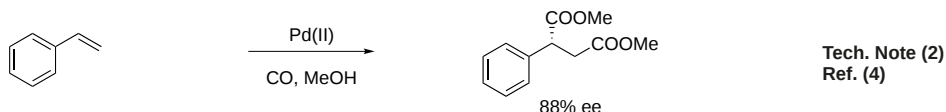
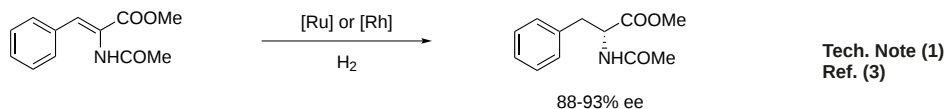
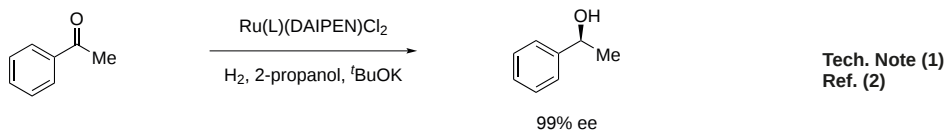
Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-5200 (continued) **(R)-(+)-2,2',6,6'-Tetramethoxy-4,4'-bis(diphenylphosphino)-3,3'-bipyridine, min. 97% CTH-(R)-P-Phos (221012-82-4)**



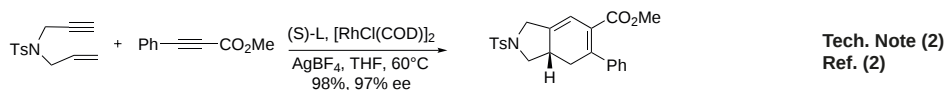
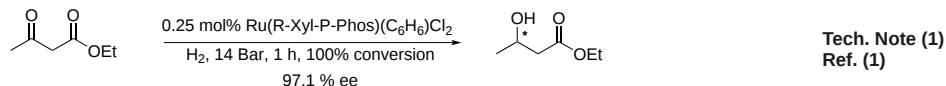
References:

1. *J. Am. Chem. Soc.*, **2000**, 122, 11513.
2. *J. Org. Chem.*, **2002**, 67, 7908.
3. *Tetrahedron: Asymmetry*, **2003**, 14, 987.
4. *J. Mol. Catal. A: Chem.*, **2003**, 196, 171.
5. *Org. Lett.*, **2014**, 16, 1944.

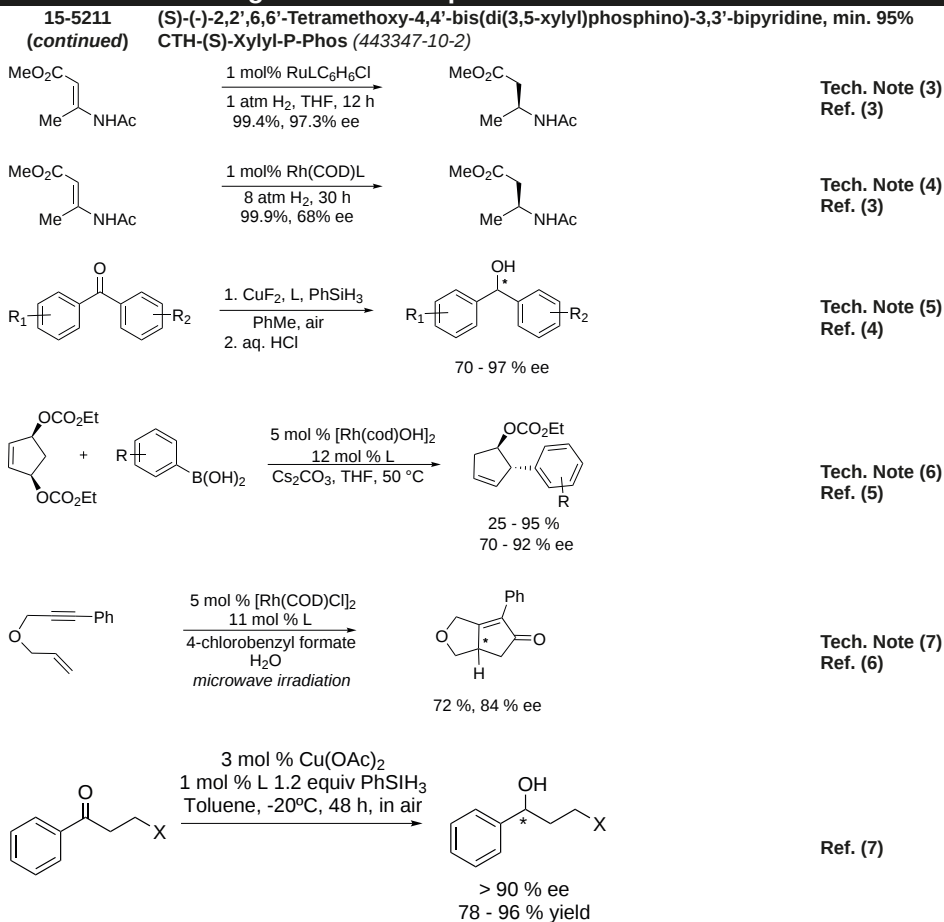
15-5211 **(S)-(-)-2,2',6,6'-Tetramethoxy-4,4'-bis(di(3,5-xylyl)phosphino)-3,3'-bipyridine, min. 95% CTH-(S)-Xylyl-P-Phos (443347-10-2)** 100mg
500mg
C₄₆H₅₀N₂O₄P₂; FW: 756.85; white to pale yellow powder.
Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent Application No US Patent 5 886 182, 1999 and patents arising therefrom.

Technical Notes:

1. Chiral ligand for the asymmetric hydrogenation of β -keto esters.
2. Chiral ligand for enantioselective rhodium-catalyzed [2+2+2] carbocyclization reactions.
3. Chiral ligand for ruthenium catalyzed hydrogenation of (E)- β -(acylamino)acrylates to β -amino acids.
4. The Rhodium complex gives higher enantioselectivity for hydrogenation of (Z)- β -(acylamino)acrylates to β -amino acids.
5. Chiral ligand for copper-catalyzed asymmetric hydrosilylation of ketones
6. Chiral ligand for asymmetric allylic substitution reactions using boronic acids as nucleophiles.
7. Gives useful selectivity in asymmetric Pauson-Khand-type cyclizations.



PHOSPHORUS - Ligands and Compounds



References:

1. *Tetrahedron Lett.*, **2002**, 43, 1539.
2. *J. Am. Chem. Soc.*, **2005**, 127, 12466.
3. *J. Org. Chem.*, **2003**, 68, 2490.
4. *Proc. Nat. Acad. Sci.*, **2005**, 102, 3570
5. *Org. Lett.*, **2006**, 8, 4569
6. *Synlett.*, **2008**, 10, 1553.
7. *Chem. Eur. J.*, **2011**, 17, 14234.

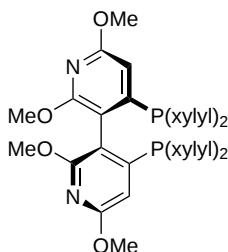
PHOSPHORUS - Ligands and Compounds

15-5210

(R)-(+)-2,2',6,6'-Tetramethoxy-4,4'-bis(di(3,5-xylyl)phosphino)-3,3'-bipyridine, min. 97% CTH-(R)-Xylyl-P-PHOS (442905-33-1)

$C_{46}H_{50}N_2O_4P_2$; FW: 756.85; white to pale yellow powdr.

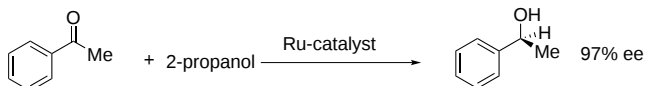
Note: Sold in collaboration with Johnson Matthey for research purposes only. US patent Application No US Patent 5 886 182, 1999 and patents arising therefrom.



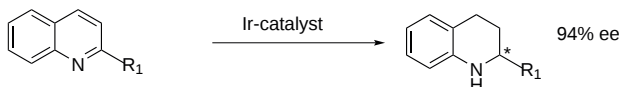
100mg
500mg

Technical Notes:

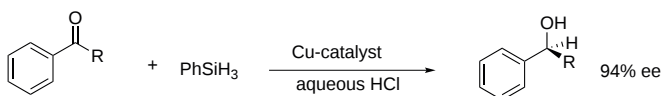
1. Chiral ligand for ruthenium catalyzed asymmetric hydrogenation of aromatic ketones.
2. Chiral ligand for iridium catalyzed asymmetric hydrogenation of quinolines.
3. Chiral ligand for copper catalyzed asymmetric hydrosilylation of ketones
4. Synthesis of new chiral 2-functionized-1,2,3,4-tetrahydroquinoline derivatives via asymmetric hydrogenation of substituted quinolines.
5. Rhodium-biphosphine-catalyzed asymmetric, intermolecular hydroheteroarylation of α -substituted acrylate derivatives.



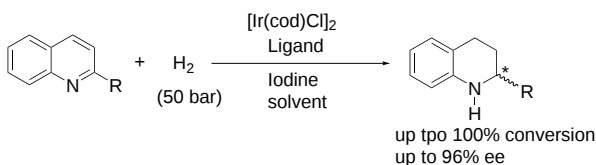
Tech. Note (1)
Ref. (1)



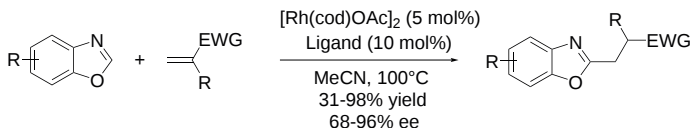
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (3)



Tech. Note (5)
Ref. (5)

References:

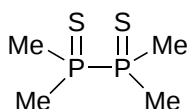
1. *J. Organomet. Chem.*, **2006**, 691, 2332.
2. *Tetrahedron Asym.*, **2007**, 18, 2625.
3. *Chem. Eur. J.*, **2009**, 15, 5888
4. *Tetrahedron*, **2013**, 69, 9322.
5. *J. Am. Chem. Soc.*, **2015**, 137, 508.

15-5350

Tetramethylbiphosphine disulfide, 99%

(3676-97-9)

$(CH_3)_2P(S)P(S)(CH_3)_2$; FW: 186.21; white xtl.; m.p. 224-228°



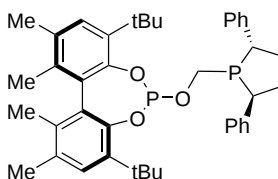
5g
25g

PHOSPHORUS - Ligands and Compounds

15-0557

NEW

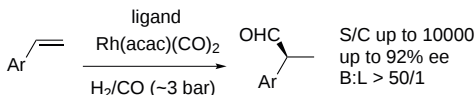
(11aS)-1,2,10,11-Tetramethyl-4,8-bis(t-butyl)-6-[[[(2S,5S)-(2,5-diphenyl-1-phospholanyl) methoxy]-dibenzo[d,f][1,3,2]dioxaphosphepin] S_{ax}S,S-BOBPHOS
(1373349-83-7)
C₄₁H₅₀O₃P₂; FW: 652.78;
white microxtl. powdr.
moisture sensitive



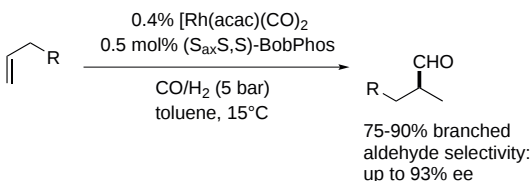
100mg
500mg

Technical Notes:

1. Rhodium/phospholane catalysts for the unusually high regioselectivity in the enantioselective hydroformylation of vinyl arenes.
2. An asymmetric hydroformylation catalyst that delivers branched aldehydes from alkyl alkenes



Tech. Note (1)
Ref. (1)



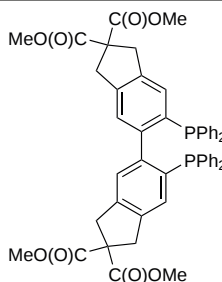
Tech. Note (2)
Ref. (2)

References:

1. *Chem Commun.*, **2014**, 50, 1475.
2. *Angew. Chem. Int. Ed.*, **2012**, 51, 2477.

15-0506

Tetramethyl 6,6'-bis(diphenylphosphino)-1,1',3,3'-tetrahydro[5,5']biindenyl-2,2',2',2'-tetracarboxylate, 99% (959864-39-2)
C₄₈H₄₄O₈P₂; FW: 810.81;
white to pale yellow powdr.
Note: Sold under license from NCL for research purposes only. Patent Pending
GB 0719134.9 and its international derivatives.



100mg
500mg

Technical Note:

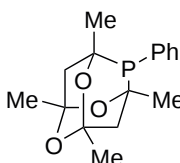
1. Ligand used in the platinum-catalyzed asymmetric carbonyl-ene reaction.

References:

1. *Org. Lett.*, **2007**, 9, 4925.

15-5355

1,3,5,7-Tetramethyl-8-phenyl-2,4,6-triox-8-phosphaadamantane, 99%
MeCgPPh (97739-46-3)
C₁₆H₂₁O₃P; FW: 292.31; white powdr.;
m.p. 107-109°
air sensitive, moisture sensitive



500mg
2g

Technical Note:

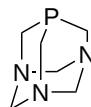
1. A bulky, robust, and electron-poor ligand that gives efficient rhodium hydroformylation and palladium cross-coupling catalysts.

References:

1. *Dalton Transactions*, **2005**, 6, 1079.
2. *Synthesis.*, **2007**, 23, 3722.
3. *Tetrahedron Lett.*, **2004**, 45, 8319.
4. *J. Org. Chem.*, **2004**, 69, 7635.

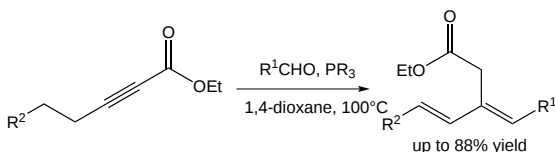
PHOSPHORUS - Ligands and Compounds

15-5360	Tetramethylphosphonium bromide, 98% (4519-28-2) (CH ₃) ₄ P ⁺ Br ⁻ ; FW: 171.02; colorless xtl. <i>hygroscopic</i>	1g 5g
15-1322	Tetraoctylphosphonium bromide, min. 95% (23906-97-0) C ₃₂ H ₆₈ BrP; FW: 563.76; white to yellow, waxy solid <i>hygroscopic</i>	5g 25g
15-5450	Tetraphenylphosphonium bromide, 99% (2751-90-8) (C ₆ H ₅) ₄ P ⁺ Br ⁻ ; FW: 419.30; white xtl.; m.p. 294-296° <i>hygroscopic</i>	5g 25g 100g
93-1591 HAZ	Thiophosphoryl chloride, 98% (3982-91-0) PSCl ₃ ; FW: 169.40; colorless liq.; m.p. -35°; b.p. 125°; d. 1.668 <i>moisture sensitive</i>	100g 500g
15-5600	p-Tolylidiphenylphosphine, min. 96% (1031-93-2) (p-CH ₃ C ₆ H ₄)(C ₆ H ₅) ₂ P; FW: 276.32; white xtl.; m.p. 64-66°	25g 100g
15-5700 amp HAZ	Triallylphosphine, min. 97% (16523-89-0) (CH ₂ =CHCH ₂) ₃ P; FW: 154.19; colorless to pale yellow liq.; b.p. 69°/13 mm; d. 0.861 <i>air sensitive</i>	1g 5g
93-1556	Tri-n-amyolphosphate, min. 97% (2528-38-3) (C ₅ H ₁₁ O) ₃ P(O); FW: 308.40; colorless liq.	25g 100g
15-5710	1,3,5-Triaza-7-phosphaadamantane, min. 97% PTA (53597-69-6) C ₆ H ₁₂ N ₃ P; FW: 157.15; white xtl.	1g 5g

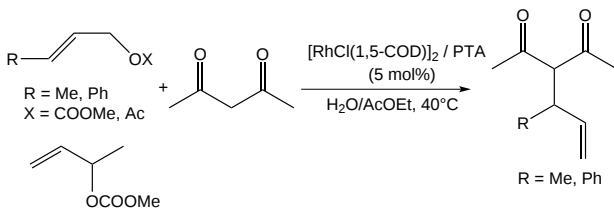


Technical Notes:

1. Air-stable, water-soluble version of trimethylphosphine.
2. Reagent used in the β -olefination of 2-alkynoates leading to trisubstituted 1,3-dienes.
3. Ligand/rhodium catalyst used in the branch selective allylation of acetylacetone.
4. Ligand/oxorhenium complex used as a catalyst for the Baeyer-Villiger oxidation of ketones.



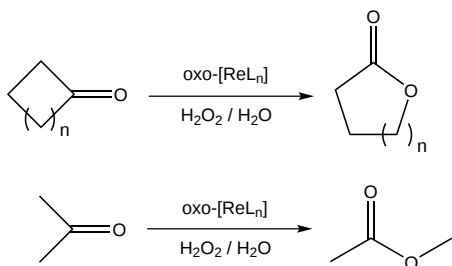
Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)

PHOSPHORUS - Ligands and Compounds

15-5710 1,3,5-Triaza-7-phosphaadamantane, min. 97% PTA (53597-69-6)
(continued)



Tech. Note (4)
Ref. (3)

References:

1. *Org. Lett.*, **2011**, 13, 3418.
2. *J. Organometallic Chem.*, **2011**, 696, 1927.
3. *Inorg. Chem.*, **2013**, 52, 4534.

15-5730	Tribenzylphosphine, 98% (7650-89-7) (C ₆ H ₅ CH ₂) ₃ P; FW: 304.37; white powdr.; m.p. 96-101° <i>air sensitive</i>		1g 5g
15-1330	Tributyl(ethyl)phosphonium diethylphosphate, 95% (20445-94-7) C ₁₈ H ₄₂ O ₄ P ₂ ; FW: 384.47; colorless to pale-yellow liq.; d. 1.007 <i>hygroscopic</i>		5g 25g
15-1327 HAZ	Tributyl(methyl)phosphonium methylsulfate, min. 95% (69056-62-8) C ₁₄ H ₃₃ O ₃ PS; FW: 328.18; white solid to pale-yellow liq.		5g 25g
15-1324	Tri-i-butyl(methyl)phosphonium tosylate, min. 95% (374683-35-9) C ₂₀ H ₃₇ O ₃ PS; FW: 388.54; white to yellow, waxy solid; d. 1.1		5g 25g
15-5750 HAZ	Tri-i-butylphosphine, min. 93% (4125-25-1) (i-C ₄ H ₉) ₃ P; FW: 202.32; colorless to light yellow liq.; b.p. 85°/7mm <i>air sensitive</i>		25g 100g
15-5801 HAZ 	Tri-n-butylphosphine, min. 93% (998-40-3) (n-C ₄ H ₉) ₃ P; FW: 202.32; colorless to light yellow liq.; b.p. 110-115°/10-12 mm; f.p. 99°F; d. 0.817 <i>pyrophoric</i>		100g 500g
15-5813 HAZ 	Tri-t-butylphosphine, min. 98% (13716-12-6) (t-C ₄ H ₉) ₃ P; FW: 202.32; colorless liq. to white solid; m.p. 30°; b.p. 102-103°/13 mm; f.p. 1°F; d. 0.812 <i>pyrophoric</i>		1g 5g
15-5818	Tri-t-butylphosphine, min. 98% (50wt% in toluene) (13716-12-6) C ₁₂ H ₂₇ P; FW: 202.32; colorless liq. <i>air sensitive</i>		2g 10g
15-5800 HAZ 	Tri-n-butylphosphine, 99% (998-40-3) (n-C ₄ H ₉) ₃ P; FW: 202.32; colorless liq.; b.p. 110-115°/10-12 mm; f.p. 99°F; d. 0.817 <i>pyrophoric</i>		25g 100g 500g
15-5802 HAZ	Tri-n-butylphosphine, 99% (10 wt% in hexanes) (998-40-3) (n-C ₄ H ₉) ₃ P; FW: 202.32; colorless liq. <i>air sensitive</i>		250g 1kg

PHOSPHORUS - Ligands and Compounds

15-5810

amp

HAZ



Tri-t-butylphosphine, 99% (13716-12-6)

(t-C₄H₉)₃P; FW: 202.32; colorless liq. to white solid; m.p. 30°;

b.p. 102-103°/13 mm; f.p. 1°F; d. 0.812

pyrophoric

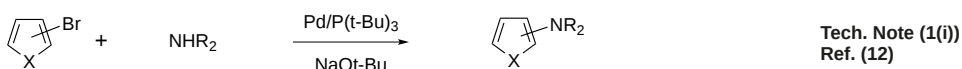
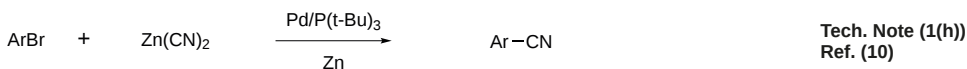
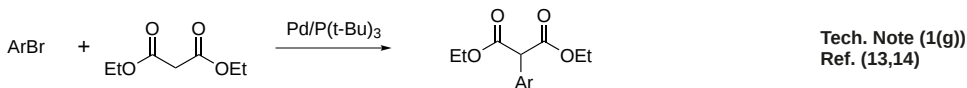
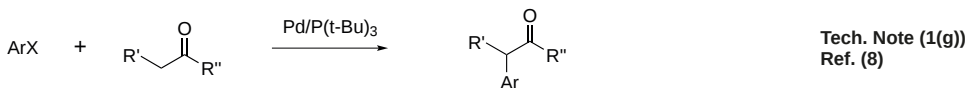
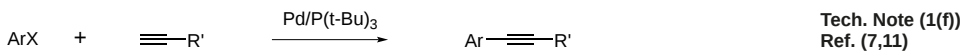
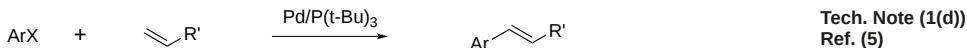
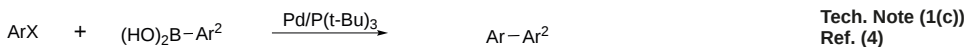
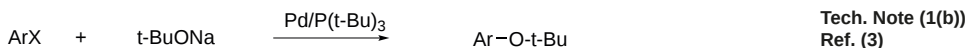
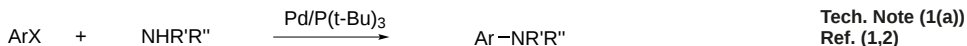
1g

5g

25g

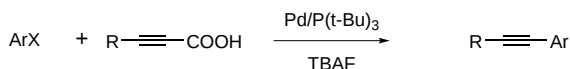
Technical Note:

- Useful as a ligand in a variety of palladium-catalyzed C-N, C-O and C-C bond-forming reactions under mild conditions.
 - Amination of aryl halides.
 - Aryl ether formation from aryl halides.
 - Suzuki cross-coupling.
 - Heck reaction for aryl chlorides.
 - Stille cross-coupling of aryl chlorides.
 - Sonogashira reaction for aryl bromides.
 - Ketone and malonate arylation.
 - Cyanation of aryl bromides.
 - Heteroaryl bromide amination.
 - Decarboxylative coupling of alkynyl carboxylic acids and aryl halides.
 - Synthesis of benzosilolo[2,3-b]indoles
 - Borylative Ketone-Diene Coupling
 - Synthesis of diaryethynyl methanes

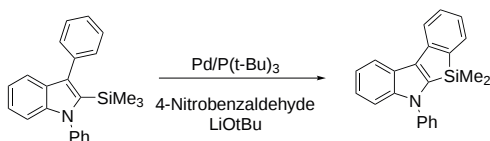


PHOSPHORUS - Ligands and Compounds

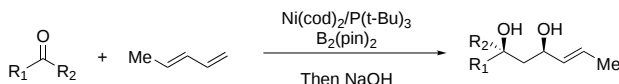
15-5810 **Tri-*t*-butylphosphine, 99% (13716-12-6)**
(continued)



Tech. Note (1(j))
Ref. (15)



Tech. Note (1(k))
Ref. (16)



Tech. Note (1(l))
Ref. (17)



Tech. Note (1(m))
Ref. (18)

References:

1. *J. Org. Chem.*, **1999**, 64, 5575.
2. *Tetrahedron Lett.*, **1998**, 39, 2367
3. *Tetrahedron Lett.*, **1999**, 40, 8837.
4. *J. Am. Chem. Soc.*, **2000**, 122, 4020.
5. *J. Org. Chem.*, **1999**, 64, 10.
6. *Angew. Chem. Int. Ed.*, **1999**, 38, 2411
7. *Org. Lett.*, **2000**, 2, 1729.
8. *J. Am. Chem. Soc.*, **1999**, 121, 1473
9. *J. Am. Chem. Soc.*, **2002**, 124, 6343.
10. *Synlett.*, **2003**, 2237.
11. *Org. Lett.*, **2003**, 5, 4191.
12. *J. Org. Chem.*, **2003**, 68, 2861.
13. *J. Org. Chem.*, **2002**, 67, 541.
14. *Chem. Commun.*, **2001**, 2704.
15. *J. Org. Chem.*, **2009**, 74, 1403.
16. *J. Am. Chem. Soc.*, **2011**, 133, 9204.
17. *Org. Lett.*, **2011**, 13, 5267.
18. *J. Am. Chem. Soc.*, **2012**, 134, 18217.

15-5811 **Tri-*t*-butylphosphine, 99% (10 wt% in hexanes) (13716-12-6)**
HAZ (t-C₄H₉)₃P; FW: 202.32; colorless liq.; d. 0.680
air sensitive

10g
50g

Technical Note:

1. See 15-5810 (page 271)

15-5812 **Tri-*t*-butylphosphine, 99% (10 wt% in hexanes) (Sure/Seal™ bottle)**
HAZ (13716-12-6)
(t-C₄H₉)₃P; FW: 202.32; colorless liq.; d. 0.680
air sensitive

50g

Technical Note:

1. See 15-5810 (page 271)

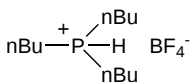
15-5950 **Tri-*n*-butylphosphite, min. 94% (102-85-2)**
(n-C₄H₉O)₃P; FW: 250.32; colorless liq.; b.p. 121-125°/6 mm; f.p. 197°F;
d. 0.925
air sensitive

250g
1kg

PHOSPHORUS - Ligands and Compounds

15-5990

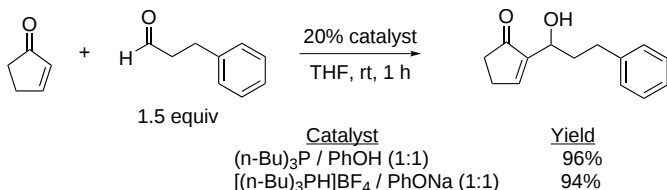
Tri-n-butylphosphonium tetrafluoroborate,
99% (113978-91-9)
 [(C₄H₉)₃PH]⁺BF₄⁻; FW: 290.13; white powdr.;
 m.p. 51-52°



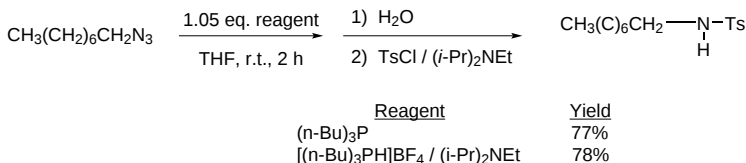
1g
5g

Technical Notes:

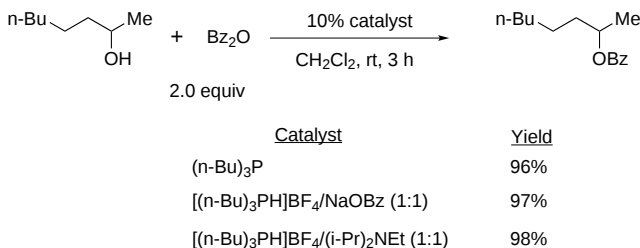
1. Air-stable, non-pyrophoric precursor of the Tri-n-butylphosphine ligand which is used in a variety of catalytic processes.
2. Catalyst in Baylis-Hillman reactions.
3. Azide reductions.
4. Acylation of alcohols by anhydrides.
5. Ligand for formate reduction of allyl carbonates.
6. Synthesis of aromatic nitriles via Pd C-H functionalization.



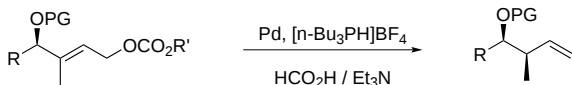
Tech. Note (2)



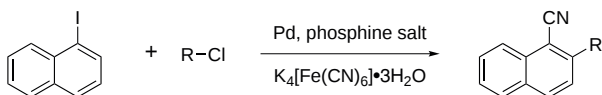
Tech. Note (3)



Tech. Note (4)



Tech. Note (5)
Ref. (2)



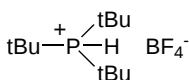
Tech. Note (6)
Ref. (3)

References:

1. *Org. Lett.*, **2001**, 3, 4295
2. *Org. Lett.*, **2003**, 5, 3391.
3. *J. Am. Chem. Soc.*, **2007**, 129, 15372.

PHOSPHORUS - Ligands and Compounds

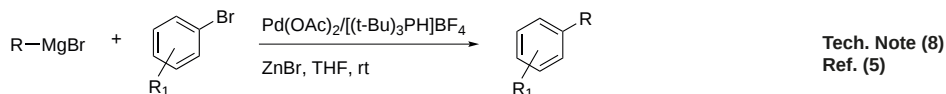
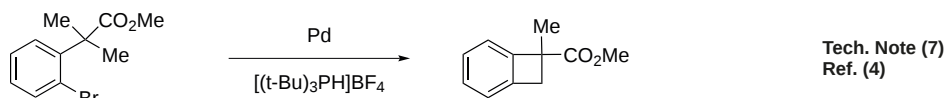
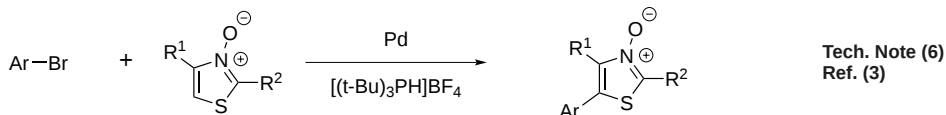
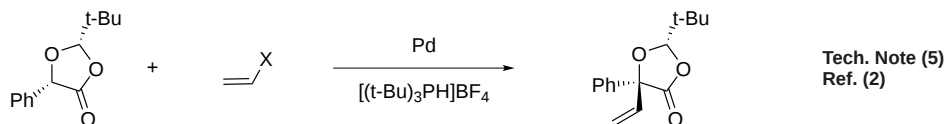
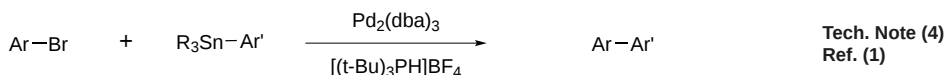
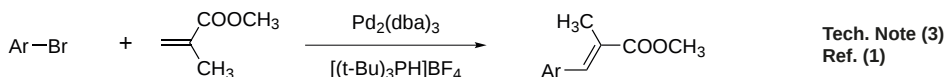
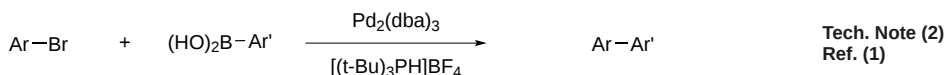
15-6000 Tri-*t*-butylphosphonium tetrafluoroborate, 99%
 (131274-22-1)
 $[(C_4H_9)_3PH]^+BF_4^-$; FW: 290.13; white powdr.;
 m.p. 261° dec.
 Note: Phosphine Ligand Kit component.



1g
 5g
 25g

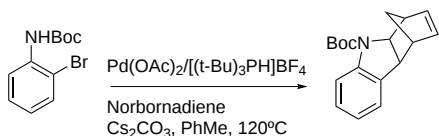
Technical Notes:

1. Air-stable, non-pyrophoric precursor of the Tri-*t*-butylphosphine ligand which is used in a variety of catalytic processes.
2. Ligand for Suzuki cross-couplings.
3. Ligand for Heck Reactions.
4. Ligand for Stille Cross-couplings.
5. Ligand for α -Arylation and vinylation of arylmandelic acid derivatives.
6. Ligand for direct arylation of heterocycles
7. Synthesis of benzocyclobutenes by C-H activation.
8. Cross-coupling of Grignard reagents and aryl bromides.
9. Palladium catalyzed annulation of haloanilines.
10. Palladium-Catalyzed Acylation.
11. Palladium Catalyzed Carbonylative Heck Reaction
12. Palladium-catalyzed aminosulfonylation.
13. Palladium-catalyzed intramolecular C–O bond formation.
14. Ruthenium-catalyzed cross-coupling of aldehydes with arylboronic acid.

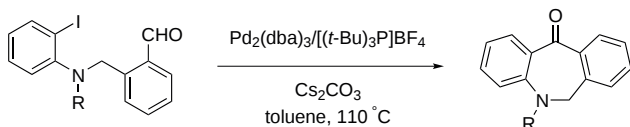


PHOSPHORUS - Ligands and Compounds

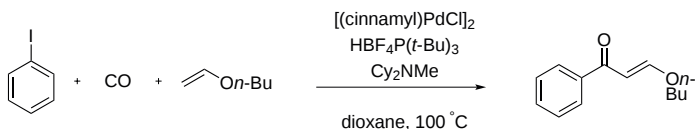
15-6000 Tri-*t*-butylphosphonium tetrafluoroborate, 99% (131274-22-1)
(continued)



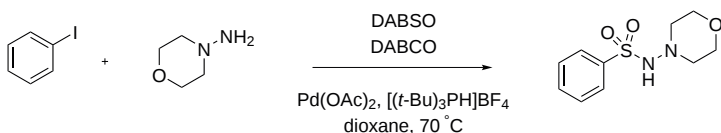
Tech. Note (9)
Ref. (6)



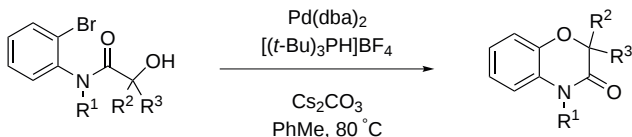
Tech. Note (10)
Ref. (7)



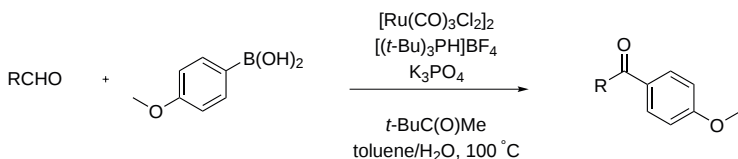
Tech. Note (11)
Ref. (8)



Tech. Note (12)
Ref. (9)



Tech. Note (13)
Ref. (10)



Tech. Note (14)
Ref. (11)

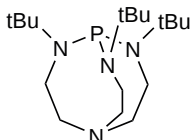
References:

1. *Org. Lett.*, **2001**, 3, 4295.
2. *Org. Lett.*, **2009**, 11, 1543.
3. *J. Am. Chem. Soc.*, **2008**, 130, 3276.
4. *J. Am. Chem. Soc.*, **2008**, 130, 15157.
5. *J. Org. Chem.*, **2009**, 75, 6677.
6. *J. Org. Chem.*, **2009**, 74, 1673.
7. *J. Org. Chem.*, **2013**, 78, 8136.
8. *Org. Lett.*, **2012**, 14, 2536.
9. *Org. Biomol. Chem.*, **2012**, 10, 4007.
10. *Chem. Commun.*, **2011**, 47, 10608.
11. *Chem. Commun.*, **2011**, 47, 7880.

15-6010 Tri-*t*-butylphosphonium trifluoromethanesulfonate, 99% Stabiphos T
(1106696-25-6)
[(C₄H₉)₃PH]⁺CF₃SO₃⁻; FW: 352.40; white solid; m.p. 175°

1g
5g

PHOSPHORUS - Ligands and Compounds

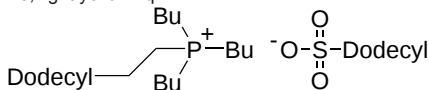
15-6020	2,8,9-Tri-<i>i</i>-butyl-2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane, 97% (331465-71-5) C ₁₈ H ₃₉ N ₄ P; FW: 342.50; cloudy yellow liq.; d. 0.964 <i>air sensitive, moisture sensitive</i>		250mg 1g 5g
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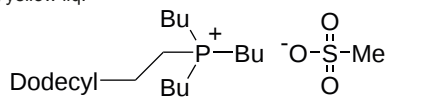
Technical Note:

- Exceedingly strong, non-ionic Brønsted and Lewis base useful in a variety of organic transformations.

References:

- Specialty Chemicals Magazine*, January/February 2006

15-5960	Tributyl(tetradecyl)phosphonium dodecylbenzenesulfonate, min. 98% CYPHOS® IL 203 [(C ₄ H ₉) ₃ (C ₁₄ H ₂₉)P] ⁺ [(C ₁₂ H ₂₅ C ₆ H ₄ SO ₃) ₂] ⁻ ; FW: 725.18; light yellow liq.		10g 50g
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15-5970	Tributyl(tetradecyl)phosphonium methanesulfonate, min. 98% CYPHOS® IL 203 [(C ₄ H ₉) ₃ (C ₁₄ H ₂₉)P] ⁺ CH ₃ SO ₃ ⁻ ; FW: 494.80; light yellow liq.		10g 50g
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15-6030	Tri(<i>m</i>-chlorophenyl)phosphine, min. 97% (29949-85-7) (<i>m</i> -ClC ₆ H ₄) ₃ P; FW: 365.63; white xtl.; m.p. 64-66° <i>air sensitive, (store cold)</i>	1g 5g
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15-6050	Tri(<i>p</i>-chlorophenyl)phosphine, 99% (1159-54-2) (<i>p</i> -ClC ₆ H ₄) ₃ P; FW: 365.63; white xtl.; m.p. 90-93°	1g 5g
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15-6151 HAZ	Tricyclohexylphosphine (20% in toluene), min. 88% (2622-14-2) (C ₆ H ₁₁) ₃ P; FW: 280.44; colorless to light yellow liq.; f.p. 40°F (toluene); d. 0.9 <i>air sensitive</i>	100g 500g
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15-6150	Tricyclohexylphosphine, 97% (2622-14-2) (C ₆ H ₁₁) ₃ P; FW: 280.44; white xtl.; m.p. 76-78° <i>air sensitive</i>	5g 25g 250g
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15-6160	Tricyclohexylphosphonium tetrafluoroborate, 99% (58656-04-5) [(C ₆ H ₁₁) ₃ PH] ⁺ BF ₄ ⁻ ; FW: 368.24; white powdr.	1g 5g 25g
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Technical Note:

- Non-pyrophoric, air-stable derivative suitable as a replacement for the neat phosphine in a variety of stoichiometric and catalytic processes.

15-6130	Tricyclohexylphosphonium trifluoromethanesulfonate, 99% Stabiphos (952649-12-6) [(C ₆ H ₁₁) ₃ PH] ⁺ CF ₃ SO ₃ ⁻ ; FW: 430.51; white solid	1g 5g
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15-6180 amp HAZ 	Tricyclopentylphosphine, min. 95% (7650-88-6) (C ₅ H ₉) ₃ P; FW: 238.35; colorless liq. <i>pyrophoric</i>	1g 5g
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15-6181 HAZ	Tricyclopentylphosphine, min. 95% (10wt% in hexanes) (7650-88-6) (C ₅ H ₉) ₃ P; FW: 238.35; colorless liq. <i>air sensitive</i>	10g 50g
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93-1559	Triethylphosphate, 99% (78-40-0) (C ₂ H ₅ O) ₃ PO; FW: 182.16; colorless liq.; m.p. -56.4°; b.p. 215°; f.p. 240°F; d. 1.072	500g 4 x 500g
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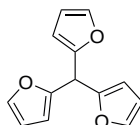
PHOSPHORUS - Ligands and Compounds

15-6300	Triethylphosphine, 99% (554-70-1)	5g
amp	(C ₂ H ₅) ₃ P; FW: 118.16; colorless liq.; b.p. 126-128°; f.p. 1°F; d. 0.81	25g
HAZ	pyrophoric	
15-6302	Triethylphosphine, 99% (Sure/Seal™ bottle) (554-70-1)	25g
HAZ	(C ₂ H ₅) ₃ P; FW: 118.16; colorless liq.; b.p. 126-128°; f.p. 1°F; d. 0.81	
	pyrophoric	
15-6304	Triethylphosphine, 99% (20 wt% in ethanol) (554-70-1)	25g
HAZ	(C ₂ H ₅) ₃ P; FW: 118.16; colorless liq.	125g
	air sensitive	
15-6305	Triethylphosphine, 99% (10 wt% in hexanes) (554-70-1)	50g
HAZ	(C ₂ H ₅) ₃ P; FW: 118.16; colorless liq.	250g
	air sensitive	
15-6310	Triethylphosphine oxide, 98% (597-50-2)	1g
	(C ₂ H ₅) ₃ PO; FW: 134.16; white xtl.; m.p. 52-53°; b.p. 84-85°/3 mm	5g
	hygroscopic	
15-6350	Triethylphosphite, 98% (122-52-1)	250g
HAZ	(C ₂ H ₅ O) ₃ P; FW: 166.16; colorless liq.; b.p. 156°; f.p. 130°F; d. 0.969	1kg
	air sensitive	
15-6355	Triethylphosphonium tetrafluoroborate, 99%	1g
	[(C ₂ H ₅) ₃ PH] ⁺ BF ₄ ⁻ ; FW: 205.97; white powdr.	5g
	hygroscopic	

Technical Note:

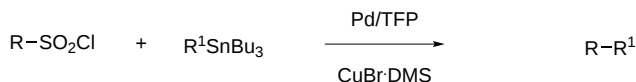
- Non-pyrophoric, air-stable derivative suitable as a replacement for the neat phosphine in a variety of stoichiometric and catalytic processes.

15-6372	Tri-2-furylphosphine, 98+% (5518-52-5)	500mg
	(C ₂ H ₃ O) ₃ P; FW: 232.17; white powdr.; m.p. 63-65°;	2g
	b.p. 136°/4mm	5g
	air sensitive	
	Note: Phosphine Ligand Kit component.	

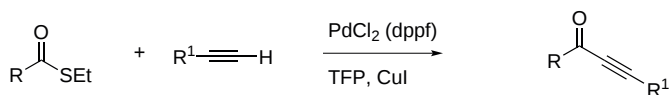


Technical Notes:

- Useful ligand for C-C coupling reactions.
- Ligand used for the alkylation of thioesters.
- Ligand used for enol ester formation.
- Ligand for palladium-catalyzed 3-Component coupling.
- Ligand for palladium-catalyzed C-C coupling reaction.
- Ligand for trans-olefin formation.
- Olefin formation from N-tosylhydrazones and benzyl halides.
- C-H arylation/alkenylation of 1-substituted tetrazoles.
- Tandem allylic amination/[2,3]-Stevens Rearrangement.
- Ligand for palladium-catalyzed carbonylation of anilines.
- Synthesis of Substituted Tetrahydrocyclobuta[b]benzofurans.
- Palladium-Catalyzed Three-Component Reaction of Allenes, Aryl Iodides, and Diazo Compounds.
- Synthesis of Benzocyclohepta[b]indoles.
- Palladium-Catalyzed Decarboxylative Allylation and Benzylation.
- Pd-catalyzed domino carbonylative-decarboxylative allylation.



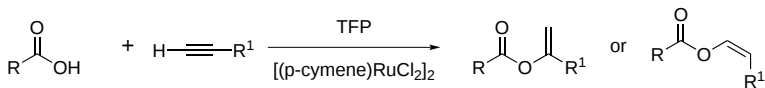
Tech. Note (1)
Ref. (1)



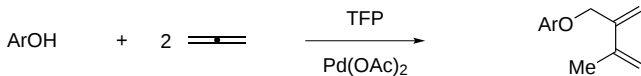
Tech. Note (2)
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PHOSPHORUS - Ligands and Compounds

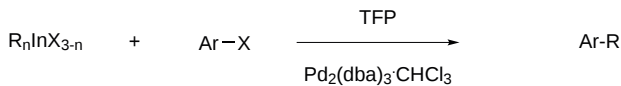
15-6372 Tri-2-furylphosphine, 98+% (5518-52-5)
(continued)



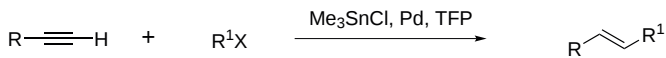
Tech. Note (3)
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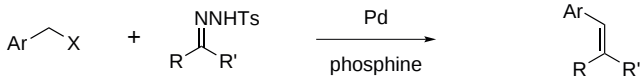
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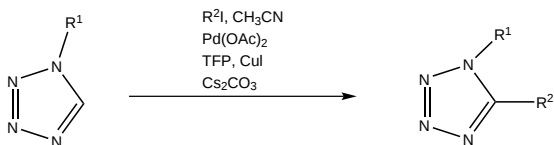
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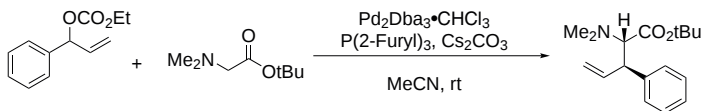
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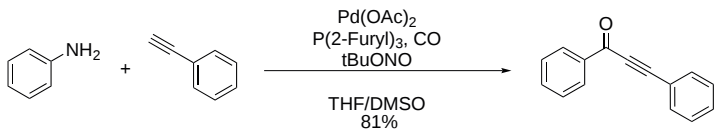
Tech. Note (7)
Ref. (8)



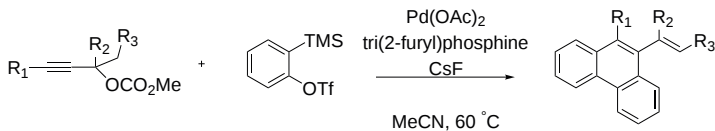
Tech. Note (8)
Ref. (9)



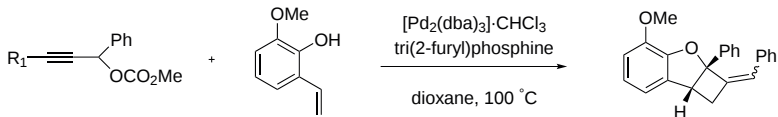
Tech. Note (9)
Ref. (10)



Tech. Note (10)
Ref. (11)



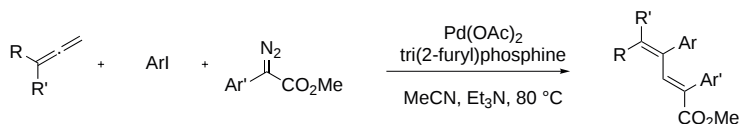
Tech. Note (11)
Ref. (12)



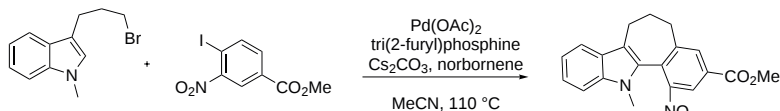
Tech. Note (12)
Ref. (13)

PHOSPHORUS - Ligands and Compounds

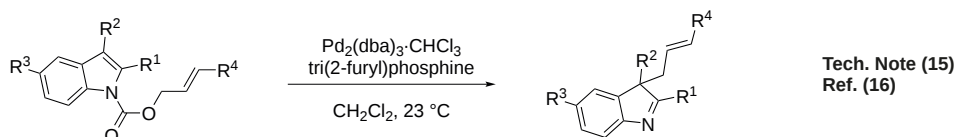
15-6372 Tri-2-furylphosphine, 98+% (5518-52-5)
(continued)



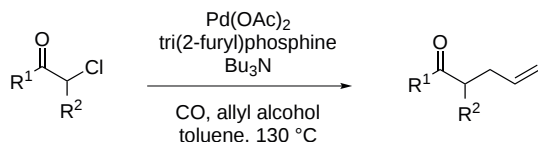
Tech. Note (13)
Ref. (14)



Tech. Note (14)
Ref. (15)



Tech. Note (15)
Ref. (16)

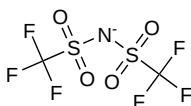


Tech. Note (16)
Ref. (17)

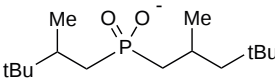
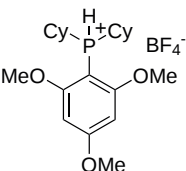
References:

1. *J. Am. Chem. Soc.*, **2003**, 125, 15292.
2. *Synlett*, **2003**, 1512.
3. *Chem. Commun.*, **2003**, 706.
4. *Tetrahedron*, **2001**, 57, 7965.
5. *Org. Lett.*, **2001**, 3, 1997.
6. *J. Am. Chem. Soc.*, **2001**, 123, 3194.
7. *Chem. Rev.*, **2001**, 101, 997. (review)
8. *Org. Lett.*, **2009**, 11, 4732.
9. *J. Org. Chem.*, **2010**, 75, 241.
10. *J. Am. Chem. Soc.*, **2011**, 133, 12956.
11. *Angew. Chem. Int. Ed.*, **2011**, 50, 11142.
12. *Synlett*, **2013**, 24, 2310.
13. *Angew. Chem. Int. Ed.*, **2013**, 52, 13597.
14. *Angew. Chem. Int. Ed.*, **2013**, 52, 9305.
15. *Synthesis*, **2013**, 45, 1094.
16. *Org. Lett.*, **2013**, 15, 1140.
17. *Chem. Commun.*, **2012**, 48, 5889.

15-1312	Tri-n-hexylphosphine, min. 96% (4168-73-4) C ₁₈ H ₃₉ P; FW: 286.48; colorless liq.; b.p. 227° (50mm); d. 0.818 <i>air sensitive</i>	5g 25g
15-1337 HAZ	Tri-n-hexylphosphine oxide/tri-n-octylphosphine oxide, min. 92% [mixture R3P(O), R2R'P(O), RR'2P(O), R'3P(O)] (100786-00-3) colorless, viscous liq.; b.p. 310° (50mm); f.p. 182° C; d. 0.88	5g 25g
15-6370	Trihexyl(tetradecyl)phosphonium bis(trifluoromethanesulfonyl) amide, min. 97% CYPHOS® IL 109 (460092-03-9) [(C ₆ H ₁₃) ₃ (C ₁₄ H ₂₉)P] ⁺ [(CF ₃ SO ₂) ₂ N] ⁻ ; FW: 764.00; colorless liq. Note: CYPHOS® IL Phosphonium Salt Ionic Liquid Kit 3 component.	10g 50g

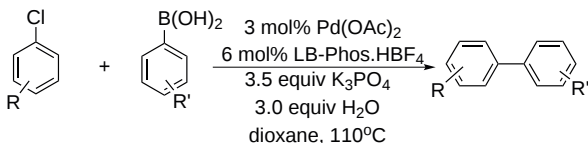


PHOSPHORUS - Ligands and Compounds

15-6374	Trihexyl(tetradecyl)phosphonium bis(2,4,4-trimethylpentyl)phosphinate, min. 95% CYPHOS® IL 104 (465527-59-7) $[(C_6H_{13})_3(C_{14}H_{29})P]^+ [[(CH_3)_3CCH_2CH(CH_3)CH_2]_2P(O)O]^-$; FW: 773.27; pale yellow liq.; d. 0.887 Note: CYPHOS® IL Phosphonium Salt Ionic Liquid Kit 3 component.	$(n\text{-Tetradecyl})-P^+(n\text{-Hexyl})_3$ 	10g 50g
15-6378	Trihexyl(tetradecyl)phosphonium bromide, min. 95% CYPHOS® IL 102 (654057-97-3) $[(C_6H_{13})_3(C_{14}H_{29})P]^+Br^-$; FW: 563.76; pale yellow liq.; d. 0.952 Note: CYPHOS® IL Phosphonium Salt Ionic Liquid Kit 3 component.		10g 50g
15-6382	Trihexyl(tetradecyl)phosphonium chloride, min. 93% CYPHOS® IL 101 (258864-54-9) $[(C_6H_{13})_3(C_{14}H_{29})P]^+Cl^-$; FW: 519.31; colorless liq.; d. 0.894 Note: CYPHOS® IL Phosphonium Salt Ionic Liquid Kit 3 component.		10g 50g
15-6386	Trihexyl(tetradecyl)phosphonium decanoate, min. 95% CYPHOS® IL 103 (465527-65-5) $[(C_6H_{13})_3(C_{14}H_{29})P]^+[CH_3(CH_2)_8COO]^-$; FW: 655.11; pale yellow semi solid; m.p. 24°; d. 0.883 Note: CYPHOS® IL Phosphonium Salt Ionic Liquid Kit 3 component.		10g 50g
15-6390	Trihexyl(tetradecyl)phosphonium dicyanamide, min. 95% CYPHOS® IL 105 $[(C_6H_{13})_3(C_{14}H_{29})P]^+[NCNHCN]^-$; FW: 550.91; pale yellow liq. Note: CYPHOS® IL Phosphonium Salt Ionic Liquid Kit 3 component.		10g 50g
15-6394	Trihexyl(tetradecyl)phosphonium hexafluorophosphate, min. 98% CYPHOS® IL 110 (374683-44-0) $[(C_6H_{13})_3(C_{14}H_{29})P]^+PF_6^-$; FW: 628.82; white solid; m.p. 50°; d. 1.013 Note: CYPHOS® IL Phosphonium Salt Ionic Liquid Kit 3 component.		10g 50g
15-6520	[2,4,6-Trimethoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98% LB-PhosHBF₄ (1217887-12-1) $C_{21}H_{34}BF_4O_3P$; FW: 452.27; white solid; m.p. 142.6-143.4° Note: Sold under license from ZJU for research purposes only. Patents ZL200910154029.4, PCT/CN2009/001527		500mg 2g

Technical Notes:

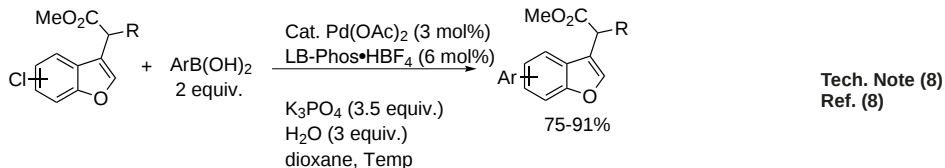
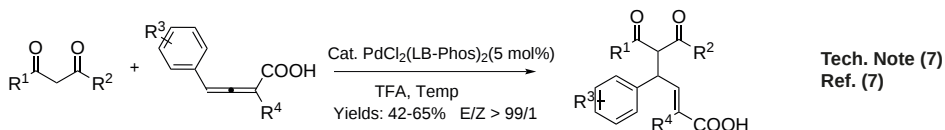
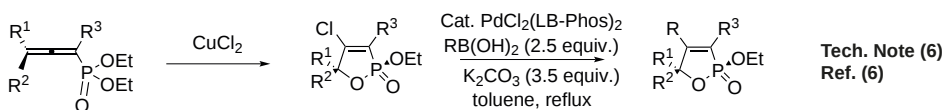
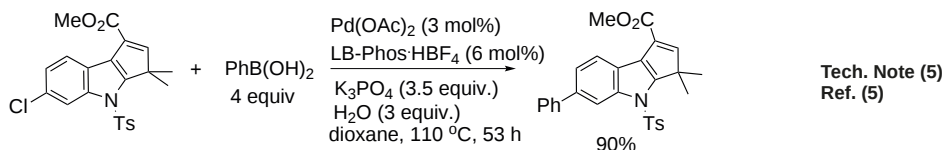
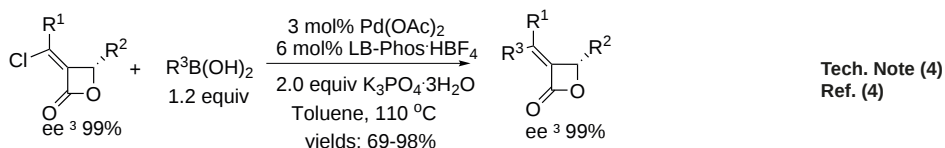
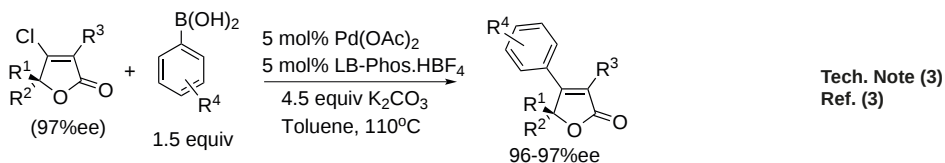
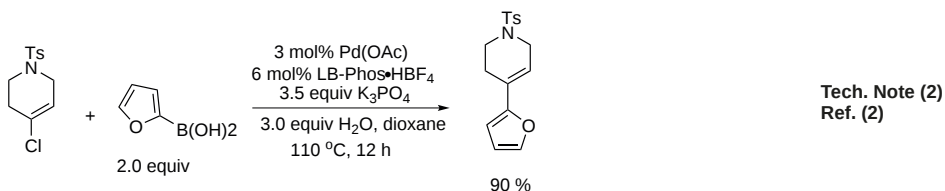
1. Suzuki-coupling reaction of aryl or 1-alkenyl chlorides.
2. Suzuki-coupling reactions of substituted furans.
3. Highly selective Suzuki-coupling of C-Cl bonds in β -chlorobutenelides.
4. Palladium-catalyzed Suzuki-coupling reactions of chloroalkylidene- β -lactones.
5. Suzuki-coupling reactions of chloro-substituted cyclopentadienylindoles.
6. Efficient synthesis of 4-halo-2,5-dihydro-1,2-oxaphosphate-2-oxides from 1,2-allenylphosphates.
7. Palladium-catalyzed reaction of 2,3-allenoates with a 1,3-diketone.
8. Suzuki-coupling of chloro-substituted benzofurans with arylboronic acids.
9. Suzuki-coupling of 2-bromoalken-3-ols with alkylboronic acids.
10. Copper-catalyzed hydroboration of alkynamides with B_2pin_2 .



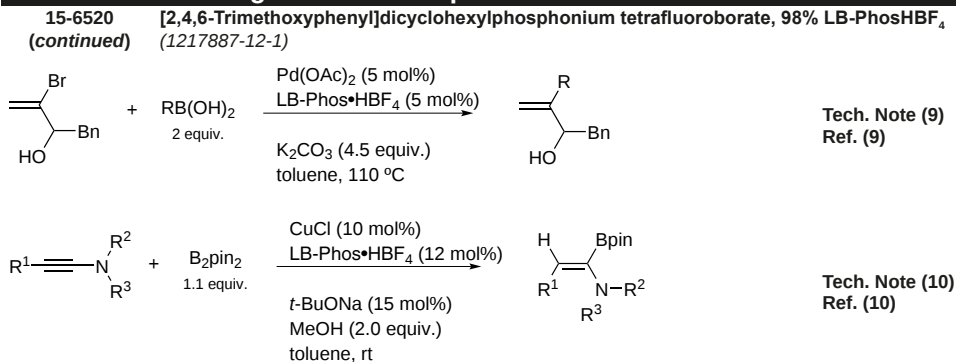
Tech. Note (1)
Ref. (1)

PHOSPHORUS - Ligands and Compounds

15-6520 [2,4,6-Trimethoxyphenyl]dicyclohexylphosphonium tetrafluoroborate, 98% LB-PhosHBF₄
(continued) (1217887-12-1)

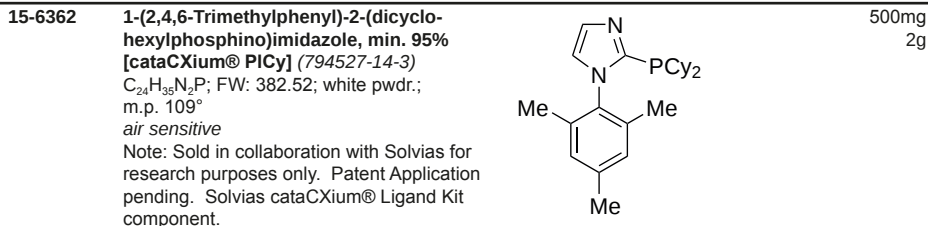
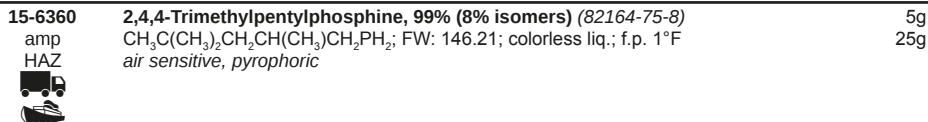


PHOSPHORUS - Ligands and Compounds



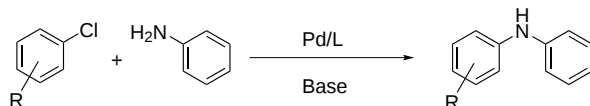
References:

1. *Tetrahedron Lett.*, **2010**, 51, 1284.
2. *Chem. Commun.*, **2012**, 48, 12074.
3. *Chem. Eur. J.*, **2010**, 16, 6434.
4. *Org. Biomol. Chem.*, **2013**, 11, 98.
5. *Org. Lett.*, **2012**, 14, 3616.
6. *Eur. J. Org. Chem.*, **2012**, 3806.
7. *Eur. J. Org. Chem.*, **2012**, 2585.
8. *Org. Lett.*, **2012**, 14, 720.
9. *Eur. J. Org. Chem.*, **2012**, 4034.
10. *Org. Biomol. Chem.*, **2014**, 12, 5945.

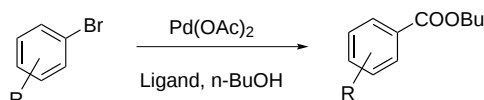


Technical Notes:

1. An efficient ligand for the palladium-catalyzed amination reaction using aryl chlorides.
2. A ligand used in the carbonylation of aryl bromides.



Tech. Note (1)
Ref. (1)



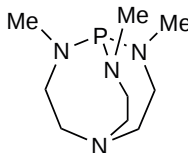
Tech. Note (2)
Ref. (2)

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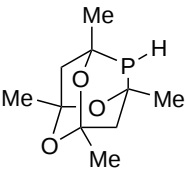
1. *Adv. Synth. Catal.*, **2004**, 346.
2. *Adv. Synth. Catal.*, **2006**, 348.

PHOSPHORUS - Ligands and Compounds

15-6365	Trimethylphenylphosphonium iodide, min. 97% (1006-01-5) (CH ₃) ₃ C ₆ H ₅ PI; FW: 280.09; white xtl.; m.p. 218° <i>hygroscopic</i>	5g 25g
93-1561	Trimethylphosphate, min. 97% (512-56-1) (CH ₃ O) ₃ P(O); FW: 140.08; colorless liq.; m.p. -46°; b.p. 197°; d. 1.197	50g 250g
15-6500 amp HAZ	Trimethylphosphine, min. 98% (594-09-2) (CH ₃) ₃ P; FW: 76.08; colorless liq.; m.p. -85°; b.p. 38-40°; f.p. -22°F; d. 0.748 <i>air sensitive, STENCH</i>	5g 25g
15-6502 HAZ	Trimethylphosphine, min. 98% (Sure/Seal™ bottle) (594-09-2) (CH ₃) ₃ P; FW: 76.08; colorless liq.; m.p. -85°; b.p. 38-40°; f.p. -22°F; d. 0.748 <i>air sensitive, STENCH</i>	25g
15-6550 HAZ	Trimethylphosphite, 97% (121-45-9) (CH ₃ O) ₃ P; FW: 124.08; colorless liq.; b.p. 110-112°; f.p. 82°F; d. 1.052 <i>air sensitive, moisture sensitive</i>	250g 1kg
15-6558 NEW HAZ	Trimethylphosphite, 99% (121-45-9) (CH ₃ O) ₃ P; FW: 124.08; colorless liq.; b.p. 110-112°; f.p. 82°F; d. 1.052 <i>air sensitive</i>	50g 250g
15-6560	Trimethylphosphonium tetrafluoroborate, 99% (154358-50-6) (CH ₃) ₃ PH ⁺ BF ₄ ⁻ ; FW: 163.89; white powdr. <i>hygroscopic</i>	1g 5g
Technical Note: 1. Non-pyrophoric, air-stable derivative suitable as a replacement for the neat phosphine in a variety of stoichiometric and catalytic processes.		
15-6400	2,8,9-Trimethyl-2,5,8,9-tetraaza-1-phospha-bicyclo[3.3.3]undecane VERKADE SUPERBASE (120666-13-9) C ₉ H ₂₁ N ₄ P; FW: 216.26; white waxy solid; m.p. 110-115° <i>moisture sensitive, (store cold)</i>	250mg 1g
Technical Note: 1. Exceedingly strong, non-ionic Brønsted and Lewis base useful in a variety of organic transformations.		
References: 1. <i>Specialty Chemicals Magazine</i> , January/February 2006.		
15-6610	Tri(1-naphthyl)phosphine, min. 98% (3411-48-1) (1-C ₁₀ H ₇) ₃ P; FW: 412.47; white powdr.; m.p. 265-268°	1g 5g
15-6620	Tri-neo-pentylphosphite, min. 90% (14540-52-4) [(CH ₃) ₃ CCH ₂ O] ₃ P; FW: 292.40; white xtl.; m.p. 55-57°; b.p. 80°/0.15 mm <i>air sensitive</i>	1g 5g
15-6655 HAZ	Tri-n-octylphosphine, min. 97% TOP (4731-53-7) (C ₈ H ₁₇) ₃ P; FW: 370.60; colorless to pale yellow liq.; m.p. 30°; b.p. 175°/0.3mm; f.p. 280°F; d. 0.83 <i>air sensitive</i> Note: Surfactant for nanomaterial synthesis.	25g 100g 500g
15-6660 HAZ	Trioctylphosphine oxide, min. 90% TOPO (78-50-2) (n-C ₈ H ₁₇) ₃ PO (n-C ₈ H ₁₇) ₃ PO; FW: 386.65; off-white xtl.; m.p. 51-52°; f.p. >230°F; d. 0.88 <i>hygroscopic</i> Note: Surfactant for nanomaterial synthesis.	100g 500g
15-6661 HAZ	Trioctylphosphine oxide, 99% TOPO (78-50-2) (n-C ₈ H ₁₇) ₃ PO; FW: 386.65; white to off-white solid; m.p. 51-52°; f.p. >230°F; d. 0.88 <i>hygroscopic</i> Note: Surfactant for nanomaterial synthesis.	25g 100g



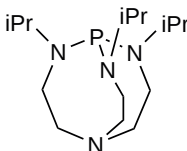
PHOSPHORUS - Ligands and Compounds

15-1310 HAZ	2,4,6-Trioxa-1,3,5,7-tetramethyl-8-phosphaadamantane (~32% in xylene) (26088-25-5) $C_{10}H_{17}O_3P$; FW: 216.21; colorless liq. <i>air sensitive</i>		5g 25g
93-1562 HAZ	Triphenylphosphate, 98% (115-86-6) $(C_6H_5O)_3P(O)$; FW: 326.28; white xtl.; m.p. 49-51°; b.p. 244°/10 mm; f.p. 428°F		500g
15-6700	Triphenylphosphine, 99% (603-35-0) $(C_6H_5)_3P$; FW: 262.28; white xtl.; m.p. 79°; b.p. 360°; f.p. 359°F		100g 500g 2kg
15-6750	Triphenylphosphine oxide, 98% (791-28-6) $(C_6H_5)_3PO$; FW: 278.28; white xtl.; m.p. 151-154°; f.p. 356°F; d. 1.212		25g 100g
15-6730	Triphenylphosphine, polymer-bound, on styrene-divinylbenzene copolymer (20% cross-linked) $(C_6H_5)_3P$; off-white beads, 20-60 mesh <i>air sensitive</i>		1g 5g 25g
15-6850	Triphenylphosphite, 97% (101-02-0) $(C_6H_5O)_3P$; FW: 310.28; colorless to yellow, low melting solid; m.p. 22-24°; b.p. 360°; f.p. 425°F; d. 1.180-1.186		500g 2kg
15-6949 amp HAZ 	Tri-i-propylphosphine, tech. gr., min. 90% (6476-36-4) $(i-C_3H_7)_3P$; FW: 160.24; colorless liq.; b.p. 176-178°; d. 0.82 <i>pyrophoric</i>		1g 5g 25g
15-6950 amp HAZ 	Tri-i-propylphosphine, 98% (6476-36-4) $(i-C_3H_7)_3P$; FW: 160.24; colorless liq.; b.p. 176-178°; d. 0.82 <i>pyrophoric</i>		1g 5g 25g
15-6952 HAZ 	Tri-i-propylphosphine, 98% (Sure/Seal™ bottle) (6476-36-4) $(i-C_3H_7)_3P$; FW: 160.24; colorless liq.; b.p. 176-178°; d. 0.82 <i>pyrophoric</i>		25g
15-6954 HAZ	Tri-i-propylphosphine, 98% (10 wt% in hexanes) (6476-36-4) $(i-C_3H_7)_3P$; FW: 160.24; colorless liq. <i>air sensitive</i>		10g 50g 250g
15-7050 amp HAZ	Tri-n-propylphosphine, min. 95% (2234-97-1) $(n-C_3H_7)_3P$; FW: 160.24; colorless liq.; b.p. 185-188°; f.p. 144°F; d. 0.807 <i>air sensitive</i>		10g 50g
15-7070	Tri-n-propylphosphine oxide, min. 98% (1496-94-2) $(n-C_3H_7)_3PO$; FW: 176.24; white xtl.; m.p. 39°; b.p. 280-282° <i>moisture sensitive</i>		1g 5g
15-7000 HAZ	Tri-i-propylphosphite, min. 94% (116-17-6) $[(CH_3)_2CHO]_3P$; FW: 208.24; colorless liq.; b.p. 63-64°/11 mm; f.p. 154°F; d. 0.844 <i>air sensitive</i>		50g 250g

PHOSPHORUS - Ligands and Compounds

15-7200

**2,8,9-Tri-*i*-propyl-2,5,8,9-tetraaza-1-phos-
phabicyclo[3.3.3]undecane** (175845-21-3)
C₁₅H₃₃N₄P; FW: 300.42; yellow liq.; f.p. 185°F;
d. 0.922
moisture sensitive



250mg
1g

Technical Note:

- Exceedingly strong, non-ionic Brønsted and Lewis base useful in a variety of organic transformations.

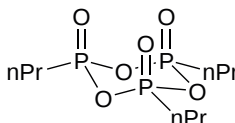
References:

- Specialty Chemicals Magazine*, January/February 2006.

15-9159

HAZ

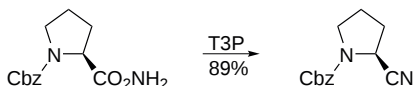
**2,4,6-Tri-*n*-propyl-2,4,6-tri-
oxo-1,3,5,2,4,6-trioxatriphosphorinane**
(Propylphosphonic acid anhydride
50% solution in *N,N*-dimethylforma-
mide) **T3P** (68957-94-8)
(C₃H₇O₂P)₃; FW: 318.20;
slightly yellow to brown liq.
moisture sensitive



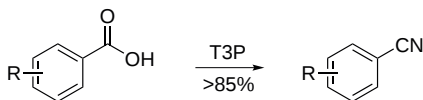
10g
50g

Technical Notes:

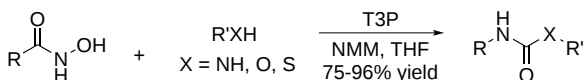
- TP3 is an exceptional reagent for amide/peptide bond formation. The product is very easy to use and combines excellent reaction selectivity, low epimerization, high yields and high product purities.
- Conversions of acids and amides to nitriles under mild conditions.
- Synthesis of urea and carbamate derivatives.
- Formation of thioacids from *N*-protected amino acids and peptides.



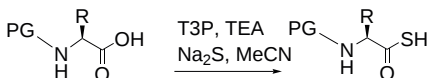
Tech. Note (2)
Ref. (1)



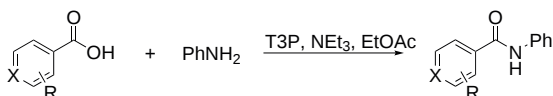
Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)



Tech. Note (4)
Ref. (3)

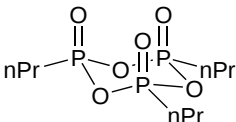
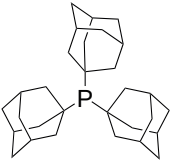
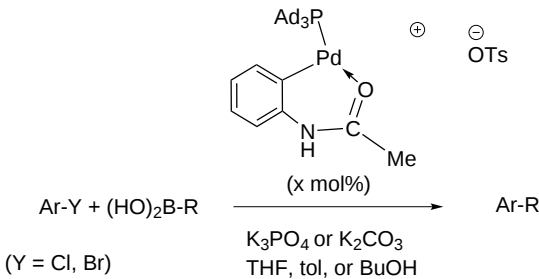
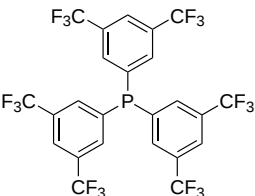
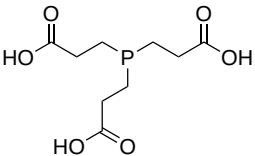


Tech. Note (4)
Ref. (1)

References:

- Unpublished work.
- Synthesis*, **2010**, 17, 2990.
- Tetrahedron Lett.*, **2012**, 53, 1406.

PHOSPHORUS - Ligands and Compounds

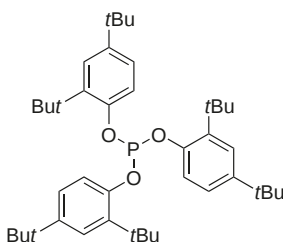
15-9160 HAZ	2,4,6-Tripropyl-2,4,6-trioxo-1,3,5,2,4,6-trioxatriphosphorinane T3P (Propylphosphonic acid anhydride) 50% solution in ethyl acetate) (68957-94-8) (C ₃ H ₇ O ₂ P) ₃ ; FW: 318.20; slightly yellow to brown liq. <i>moisture sensitive</i>		10g 50g
15-0935 NEW	Tris(1-adamantyl)phosphine, 97% (897665-73-5) C ₃₀ H ₄₅ P; FW: 436.65; white to off-white powdr. <i>air sensitive</i> Note: Sold in collaboration with GreenCentre for research purposes only. Patents: 62248056.		250mg 1g 5g
Technical Note: 1. A stable phosphine ligand which can bind to metals such as palladium to be used in Suzuki-Miyaura couplings in making drug intermediates. Dramatic effects in catalysis are also accessible now by using PAd3 as a ligand during Suzuki-Miyaura cross-coupling of chloro(hetero)arenes. ^{1,2}			
			
References: 1. <i>Synlett.</i> , 2017 , 28(3), 280-288. 2. <i>J. Am. Chem. Soc.</i> , 2016 , 138, 6392.			
15-9165	Tris[3,5-bis(trifluoromethyl)phenyl]phosphine, 97% (175136-62-6) C ₂₄ H ₉ F ₁₈ P; FW: 670.37; brown solid		250mg 1g 5g
15-7400	Tris(2-carboxyethyl)phosphine, hydrochloride, 99% TCEP (51805-45-9) (HOOCCH ₂ CH ₂) ₃ PH ⁺ Cl ⁻ ; FW: 286.65; white xtl.		1g 5g
93-1564	Tris(2-chloroethyl)phosphate, 97% (115-96-8) (ClCH ₂ CH ₂ O) ₃ P(O); FW: 285.52; colorless liq.; m.p. -51°; b.p. 330°; f.p. 450°F; d. 1.39		500g 2kg
15-7680	Tris(2-cyanoethyl)phosphine, min. 99% (4023-53-4) P(CH ₂ CH ₂ CN) ₃ ; FW: 193.19; white xtl.; m.p. 97-98°; b.p. 235°/0.9 mm		5g 25g

Tech. Note (1)
Ref. (1,2)

PHOSPHORUS - Ligands and Compounds

15-7720

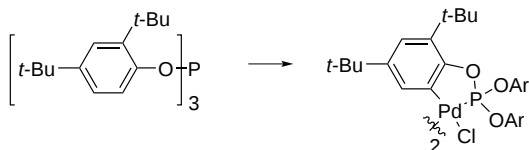
Tris(2,4-di-*t*-butylphenyl) phosphite, 98% (31570-04-4)
 $[[(\text{CH}_3)_3\text{C}]_2\text{C}_6\text{H}_3\text{O}]_3\text{P}$; FW: 646.93;
 white powdr.; m.p. 181-184°
moisture sensitive
 Note: Phosphine Ligand Kit component.



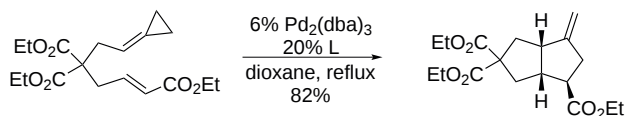
10g
250g
1kg

Technical Notes:

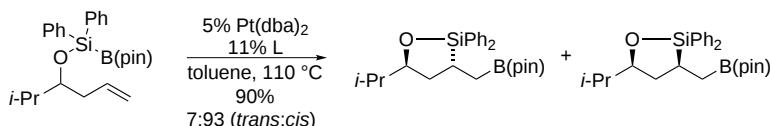
1. Precursor to a palladacyclic catalyst for Suzuki, Stille and Heck processes.
2. Ligand for Pd-catalyzed [3+2] intramolecular cycloaddition of alk-5-enylenecyclopropanes.
3. Ligand for Pt-catalyzed intramolecular silaboration of alkenes.
4. Ligand for Ni-catalyzed aminocarbonylation of aryl halides.
5. Ligand for the Au-catalyzed [4+2] intramolecular cycloaddition of allene-dienes.
6. Rhodium-Catalyzed Allylic Substitution with an Acyl Anion Equivalent.



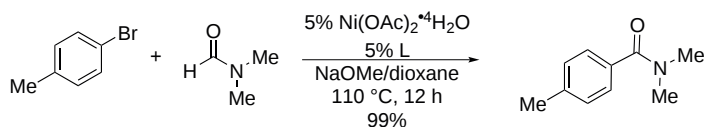
Tech. Note (1)
Ref. (1-3)



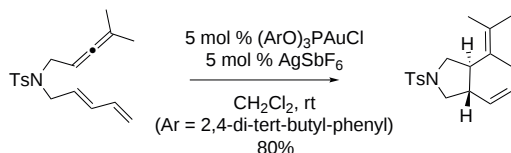
Tech. Note (2)
Ref. (4)



Tech. Note (3)
Ref. (5)



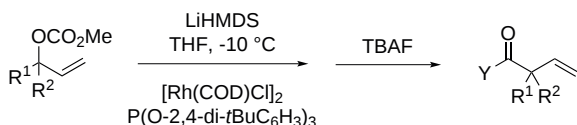
Tech. Note (4)
Ref. (6)



Tech. Note (5)
Ref. (7)

PHOSPHORUS - Ligands and Compounds

15-7720 Tris(2,4-di-*t*-butylphenyl)phosphite, 98% (31570-04-4)
(continued)

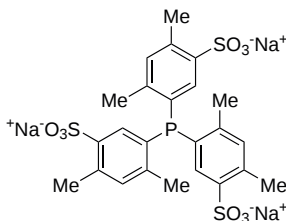
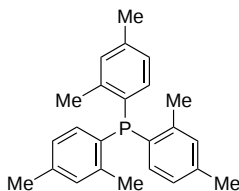


Tech. Note (6)
Ref. (8)

References:

1. *Chem. Commun.*, 1998, 2095.
2. *Tetrahedron Lett.*, **1998**, 39, 9793.
3. *Chem.-Eur. J.*, **2003**, 9, 3216.
4. *J. Am. Chem. Soc.*, **2006**, 128, 384.
5. *J. Am. Chem. Soc.*, **2006**, 128, 13366.
6. *Org. Lett.*, **2007**, 9, 4615.
7. *J. Am. Chem. Soc.*, **2009**, 131, 6348.
8. *J. Am. Chem. Soc.*, **2012**, 134, 19314.

15-7725 NEW	Tris(2,6-dimethoxyphenyl)phosphine, min. 97% (85417-41-0) $\text{C}_{24}\text{H}_{27}\text{O}_6\text{P}$; white to off-white powdr.; m.p. 145-147° <i>air sensitive</i>	5g
15-7800 amp HAZ	Tris(dimethylamino)phosphine, min. 98% HMPT (1608-26-0) $[(\text{CH}_3)_2\text{N}]_3\text{P}$; FW: 163.21; yellow liq.; b.p. 49-51°/12 mm; f.p. 98°F; d. 0.898 <i>air sensitive, moisture sensitive</i>	1g 5g
15-7830	Tris(2,4-dimethylphenyl)phosphine, 98% (49676-42-8) $[(\text{CH}_3)_2\text{C}_6\text{H}_3]_3\text{P}$; FW: 346.45; white powdr.; m.p. 157-158°	500mg 2g
15-7820	Tris(3,5-dimethylphenyl)phosphine, 98% (69227-47-0) $[(\text{CH}_3)_2\text{C}_6\text{H}_3]_3\text{P}$; FW: 346.45; white xtl.; m.p. 160-163°	500mg 2g
15-7860	Tris(4,6-dimethyl-3-sulfonatophenyl)phosphine trisodium salt hydrate, min. 97% TXPTS (443150-11-6) $[(\text{CH}_3)_2(\text{C}_6\text{H}_2)\text{SO}_3\text{Na}]_3\text{P}\cdot\text{XH}_2\text{O}$; FW: 652.58; white powdr.	250mg 1g



Technical Note:

1. A water-soluble phosphine. Phosphine used in the efficient, aqueous-phase Heck and Suzuki couplings of aryl bromides.

References:

1. *Organic Lett.*, **2004**, 6(2), 225.

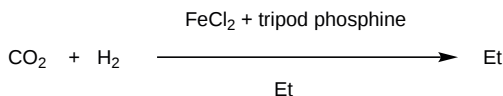
PHOSPHORUS - Ligands and Compounds

15-7888 **Tris[2-(diphenylphosphino)ethyl]phosphine, 98% PP₃ (23582-03-8)**
 C₄₂H₄₂P₄; FW: 670.68; white powdr.

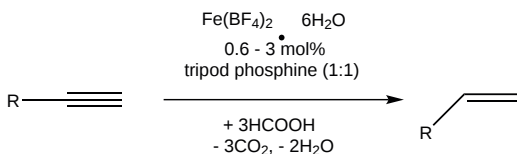
250mg
1g

Technical Notes:

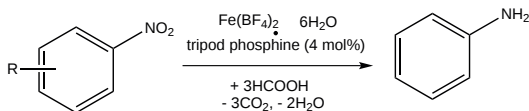
1. Ligand used in the ruthenium-catalyzed hydrogenation of carbon dioxide facilitated by catalytic quantities of bicarbonate.
2. Ligand used in the selective iron-catalyzed transfer hydrogenation of terminal alkynes.
3. Ligand used in the selective iron-catalyzed transfer hydrogenation of nitoarenes, without base.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

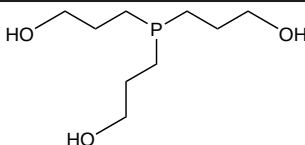


Tech. Note (3)
Ref. (3)

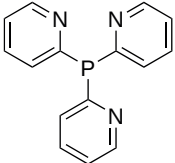
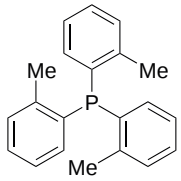
References:

1. *Organometallics*, **2013**, 32, 6891.
2. *Chem. Commun.*, **2012**, 48, 4827.
3. *J. Am. Chem. Soc.*, **2011**, 133, 12875.

15-7880	1,1,1-Tris(diphenylphosphino)methane, 97% (28926-65-0)	1g
	HC[P(C ₆ H ₅) ₂] ₃ ; FW: 568.58; white xtl.; m.p. 168-172°	5g
15-7870	1,1,1-Tris(diphenylphosphinomethyl)ethane, min. 97% TRIPHOS (22031-12-5)	1g
	CH ₃ C[CH ₂ P(C ₆ H ₅) ₂] ₃ ; FW: 624.68; white powdr.; m.p. 98-101°	5g
15-7890	Tris(p-fluorophenyl)phosphine, 99% (18437-78-0)	1g
	(p-F-C ₆ H ₄) ₃ P; FW: 316.27; off-white xtl.; m.p. 80-81°	5g
15-7900 HAZ	Tris(hydroxymethyl)phosphine, min. 85% (2767-80-8)	1g
	P(CH ₂ OH) ₃ ; FW: 124.08; colorless solid to viscous liq. <i>air sensitive</i>	5g
15-7901 HAZ	Tris(hydroxymethyl)phosphine, min. 95% (2767-80-8)	250mg
	P(CH ₂ OH) ₃ ; FW: 124.08; colorless to pale yellow solid <i>air sensitive</i>	1g
15-6375 amp HAZ	Tris(3-hydroxypropyl)phosphine, min. 80% (4706-17-6)	2g
	(HOC ₃ H ₆) ₃ P; FW: 208.24; viscous liq. <i>air sensitive</i> Note: Surfactant for nanomaterial synthesis.	10g 50g
15-7940	Tris(4-methoxy-3,5-dimethylphenyl)phosphine, min. 98% (121898-64-4)	1g
	[(CH ₃) ₂ (OCH ₃)C ₆ H ₂] ₃ P; FW: 436.52; white xtl.; m.p. 175-177°	5g
15-7975	Tris(m-methoxyphenyl)phosphine, 97+% (29949-84-6)	1g
	(m-CH ₃ OC ₆ H ₄) ₃ P; FW: 352.37; white xtl.; m.p. 115°	5g
15-7950	Tris(o-methoxyphenyl)phosphine, min. 98% (4731-65-1)	1g
	(o-CH ₃ OC ₆ H ₄) ₃ P; FW: 352.37; white xtl.; m.p. 203-205°	5g



PHOSPHORUS - Ligands and Compounds

15-8000	Tris(p-methoxyphenyl)phosphine, 98% (855-38-9) (p-CH ₃ OC ₆ H ₄) ₃ P; FW: 352.37; white to pale yellow xtl.; m.p. 132-135°	1g 5g
15-8005	Tris(pentafluorophenyl)phosphine, 98% (1259-35-4) (C ₆ F ₅) ₃ P; FW: 532.15; white powdr.; m.p. 117-119°	1g 5g
15-7945 NEW	Tris(2-pyridyl)phosphine, min. 97% (26437-48-9) (C ₅ H ₄ N) ₃ P; FW: 265.25; white to off-white powdr.; m.p. 112-114° <i>air sensitive</i>	250mg 1g
		
15-8013	Tris(3-sulfonatophenyl)phosphine hydrate, sodium salt (<5% oxide) (63995-70-0) Na ₃ P(C ₆ H ₄ SO ₃) ₃ ·XH ₂ O; FW: 568.40; white to off-white powdr.	250mg 1g
15-8007	Tris(3-sulfonatophenyl)phosphine hydrate, sodium salt (<10% oxide) (63995-70-0) Na ₃ P(C ₆ H ₄ SO ₃) ₃ ·XH ₂ O; FW: 568.40; white to off-white powdr.	250mg 1g 5g
15-8010	Tris(p-trifluoromethylphenyl)phosphine, min. 97% (13406-29-6) (p-CF ₃ C ₆ H ₄) ₃ P; FW: 466.28; pale yellow powdr.; m.p. 73-75°	1g 5g
15-8015	Tris(2,4,6-trimethoxyphenyl)phosphine, min. 97% (91608-15-0) [(CH ₃ O) ₃ C ₆ H ₂] ₃ P; FW: 532.54; light yellow powdr.; m.p. 155-160° <i>air sensitive</i>	2g 10g
15-8017	Tris(2,4,6-trimethylphenyl)phosphine, 98% (23897-15-6) [(CH ₃) ₃ C ₆ H ₂] ₃ P; FW: 388.53; white powdr.; m.p. 185°	1g 5g
15-8020 amp HAZ 	Tris(trimethylsilyl)phosphine, min. 98% (15573-38-3) [(CH ₃) ₃ Si] ₃ P; FW: 250.54; colorless to pale yellow, low melting solid; m.p. 24°; b.p. 102-105°/16 mm; f.p. -1°F; d. 0.863 <i>pyrophoric</i>	250mg 1g 5g
15-8021 HAZ	Tris(trimethylsilyl)phosphine, min. 98% (10 wt% in hexanes) (15573-38-3) [(CH ₃) ₃ Si] ₃ P; FW: 250.54; colorless liq. <i>air sensitive</i>	10g 50g
15-8100	Tri-m-tolylphosphine, 98% (6224-63-1) (m-CH ₃ C ₆ H ₄) ₃ P; FW: 304.37; white xtl.; m.p. 100° <i>air sensitive</i>	5g 25g
15-8120	Tri-p-tolylphosphine, 98% (1038-95-5) (p-CH ₃ C ₆ H ₄) ₃ P; FW: 304.37; white xtl.; m.p. 145-148° <i>air sensitive</i>	5g 25g
15-8050	Tri-o-tolylphosphine, 99% (6163-58-2) (o-CH ₃ C ₆ H ₄) ₃ P; FW: 304.37; white xtl.; m.p. 125-128° <i>air sensitive</i> Note: Phosphine Ligand Kit component.	5g 25g
		
15-9150 amp	Vinyldiphenylphosphine, min. 97% (2155-96-6) (CH ₂ =CH)(C ₆ H ₅) ₂ P; FW: 212.23; colorless to yellow liq.; b.p. 135°/3.5 mm; f.p. >230°F; d. 1.067 <i>air sensitive, (store cold)</i>	1g 5g 25g
15-9155 HAZ	Vinylphosphonic acid, min. 90% (1746-03-8) CH ₂ =CHP(O)(OH) ₂ ; FW: 108.00; colorless to pale-yellow liq.; m.p. 36°	50g 250g
15-9158 HAZ	Vinylphosphonic acid dimethyl ester, min. 90% (4645-32-3) CH ₂ =CHP(O)(OCH ₃) ₂ ; FW: 136.10; colorless liq. <i>(store cold)</i>	50g 250g

CATALYST & ORGANOCATALYST KITS - BASF Blocking Group Removal Catalyst Kit

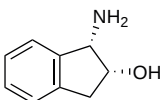
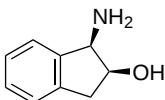
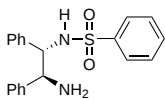
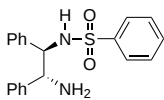
96-6715 BASF Blocking Group Removal Catalyst Kit
 Sold in collaboration with BASF for research purposes only.
 Components also available for individual sale.
 Contains the following:

46-1905	Palladium, 10% on activated wood carbon, reduced, 50% water wet (Escat™ 1931) (7440-05-3)	10g
46-1906	Palladium, 10% on activated wood carbon, unreduced, 50% water wet (Escat™ 1921) (7440-05-3)	10g
46-1907	Palladium, 3% on activated carbon, reduced, 50% water wet paste (Escat™ 1911) (7440-05-3)	10g
46-1908	Palladium, 5% on activated carbon, reduced, 50% water wet paste (Escat™ 1941) (7440-05-3)	10g
46-1909	Palladium, 5% on activated carbon, reduced, 50% water wet paste (Escat™ 1961) (7440-05-3)	10g
46-1911	Palladium, 5% on activated carbon, reduced, 50% water wet paste (Escat™ 1971) (7440-05-3)	10g

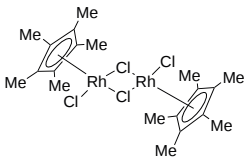
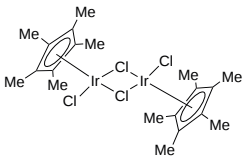
CATALYST & ORGANOCATALYST KITS - CATHy™ Catalyst Kit

96-7650 CATHy™ Catalyst Kit for Asymmetric Transfer Hydrogenation of Ketones and Imines
 For asymmetric transfer hydrogenation of ketones and imines.
 Components also available for individual sale. Contains the following:

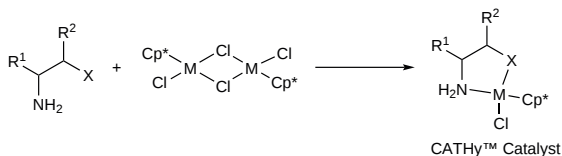
Chiral Bidentate Nitrogen Ligands

			
07-0200 1g	07-0201 1g	07-2370 500mg	07-2371 500mg

Rhodium & Iridium Components

	
45-0195 500mg	77-1060 500mg

Catalyst Preparation



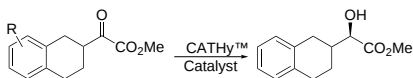
Technical Notes:

1. Catalyst for asymmetric ketone reduction in organic and aqueous media
2. Catalyst for asymmetric imine reduction in organic and aqueous media
3. Catalyst for asymmetric oxidative lactonizations of meso-diols
4. Catalyst for asymmetric transfer hydrogenation of quinolines

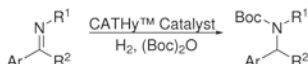
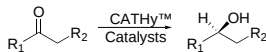
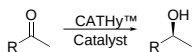
CATALYST & ORGANOCATALYST KITS - CATHy™ Catalyst Kit

96-7650

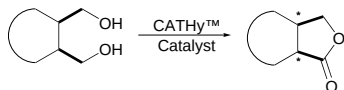
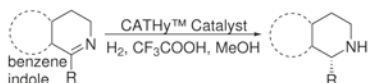
CATHy™ Catalyst Kit for Asymmetric Transfer Hydrogenation of Ketones and Imines
(continued)



Tech. Note (1)
Ref. (1-7)



Tech. Note (2)
Ref. (1, 8-10)



Tech. Note (3)
Ref. (11)



Tech. Note (4)
Ref. (12-13)

References:

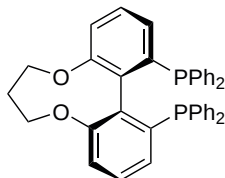
1. Blacker A.J., Mellor B.J. WO9842643A1, filed 26/03/97, Avecia Ltd.; Blacker A.J. Conf. Proceedings: The Scale up of Chemical Processes. Jersey 1998 ISBN 0953399400;
2. *Tetrahedron*, **2006**, 62, 1864
3. *Org. Lett.*, **2007**, 9, 2565
4. *Chem. Eur. J.* **2008**, 14, 2209
5. *J. Org. Chem.* **2010**, 75, 2981
6. *J. Org. Chem.* **2015**, 80, 4419
7. *J. Organometal. Chem.* **2016**, 810, 12
8. *Chem. Eur. J.* **2011**, 17, 1109
9. *Org. Lett.* **2015**, 17, 2878
10. *Chem. Commun.*, **2016**, 52, 362
11. *Organometallics* **2002**, 21, 3493
12. *Org. Lett.*, **2008**, 10, 5265
13. *Angew. Chem. Int. Ed.* **2009**, 48, 6524

CATALYST & ORGANOCATALYST KITS - Chiral Quest Catalyst & Ligand Toolbox Kit

96-5900

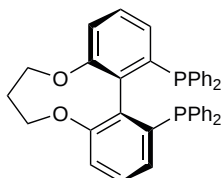
Chiral Quest Catalyst and Ligand Toolbox Kit for Asymmetric Hydrogenation

Components also available for individual sale. Contains the following:



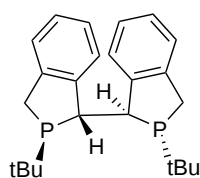
15-0175
(R)-C₃-TUNEPHOS

100mg



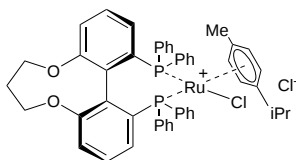
15-0176
(S)-C₃-TUNEPHOS

100mg



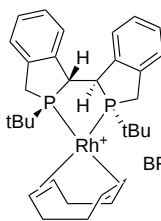
15-1060
(R,R,S,S)-DUANPHOS

100mg



44-0109
(R)-C₃-TUNEPHOS-Ru

100mg



45-0663
(R,R,S,S)-DUANPHOS-Rh

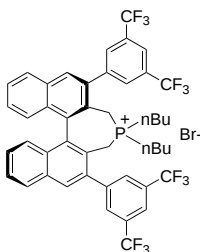
100mg

CATALYST & ORGANOCATALYST KITS - Maruoka Chiral Phase-Transfer Phosphonium Organocatalyst Kit

96-3750

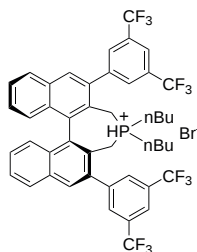
Maruoka Chiral Phase-Transfer Phosphonium Organocatalyst Kit

Components also available for individual sale. Contains the following:



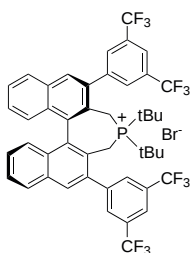
15-1457
R-MARUOKA CAT P-NB

50mg



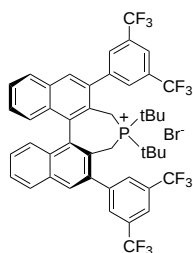
15-1458
S-MARUOKA CAT P-NB

50mg



15-1464
R-MARUOKA CAT P-TB

50mg



15-1465
S-MARUOKA CAT P-TB

50mg

CATALYST & ORGANOCATALYST KITS - Palladium Kit

96-4650

Palladium Kit

For a variety of catalytic organic transformations.

Components also available for individual sale.

Contains the following:

46-0100	Allylpalladium chloride dimer, min. 98% (12012-95-2)	500mg
46-0400	Dichlorobis(benzonitrile)palladium(II), 99% (14220-64-5)	1g
46-1780	Palladium(II) acetate, min. 98% (99.9+%-Pd) (3375-31-3)	1g
46-1850	Palladium(II) chloride (99.9%-Pd) (7647-10-1)	1g
46-2150	Tetrakis(triphenylphosphine)palladium(0), 99% (99.9+%-Pd) (14221-01-3)	5g
46-3000	Tris(dibenzylideneacetone)dipalladium(0) (51364-51-3)	5g
46-3010	Tris(dibenzylideneacetone)dipalladium(0) chloroform adduct (52522-40-4)	500mg

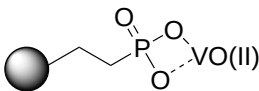
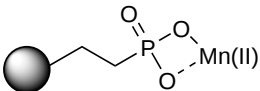
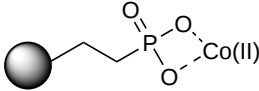
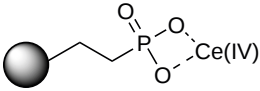
CATALYST & ORGANOCATALYST KITS - PhosphonicS Metal Oxidation Catalyst Kit

96-6770

PhosphonicS Metal Oxidation Catalyst Kit

Sold in collaboration with PhosphonicS Ltd. for research purposes only.

Components also available for individual sale. Contains the following:

 23-4380 PhosphonicS POVO 5g	 25-1200 PhosphonicS POMn 5g
 27-0900 PhosphonicS POCO 5g	 58-5100 PhosphonicS POCE 5g

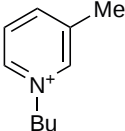
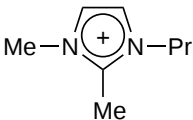
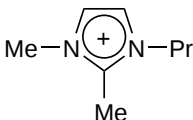
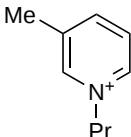
Reactions such as allylic and benzylic oxidations, alcohol oxidations and epoxidations are key chemical transformations in organic synthesis. In general these reactions are conducted by the use of stoichiometric, or even higher concentrations, of inorganic oxidants. Typical oxidizing agents include potassium permanganate, manganese dioxide, chromium trioxide, potassium chromate, potassium dichromate and peracids. These hazardous reagents produce large volumes of toxic wastes that are becoming increasingly costly to treat and dispose. In addition, difficulties are often encountered in the work up of reactions and purification of the products. There is a need for new heterogeneous oxidation catalysts that are not only effective, but exhibit ease of recovery and recyclability. PhosphonicS has developed a number of novel heterogeneous oxidation catalysts for a wide range of applications in the pharmaceutical, fine chemicals and petrochemical industries. Reactions include allylic and benzylic oxidations, epoxidations and the selective oxidations of alcohols to ketones and sulfides to sulfoxides.

IONIC LIQUID KITS - Ionic Liquid Kit 1: Hydrophobic (water-immiscible) Kit

96-6500

Ionic Liquid Kit 1: Hydrophobic (water-immiscible) Kit

Components also available for individual sale. Contains the following:

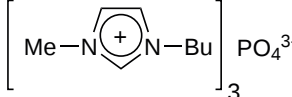
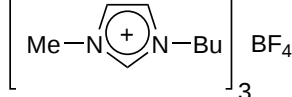
 $[N(SO_2CF_3)_2]^-$ 07-0180 [BMPIm] 1g	 $[NH(SO_2CF_3)_2]^-$ 07-0465 [DMPIm] 1g	 $(CF_3SO_2)_3C^-$ 07-0470 [DMPIme] 500mg
 $[(CF_3CF_2SO_2)_2N]^-$ 07-0578 [EMIBeti] 500mg	 $[N(SO_2CF_3)_2]^-$ 07-0579 [EMIm] 1g	 $[N(SO_2CF_3)_2]^-$ 07-1775 [PMPIm] 1g

IONIC LIQUID KITS - Ionic Liquid Kit 2: BMIM Kit

96-6510

Ionic Liquid Kit 2: BMIM Kit

Components also available for individual sale. Contains the following:

 Me-N⁺(C₄H₄N)⁺-N-Bu Cl⁻ 07-0100 [BMIM]Cl 10g	 Me-N⁺(C₄H₄N)⁺-N-Bu MeOSO₃⁻ 07-0140 [BMIM] [MeSO₄] 5g	 Me-N⁺(C₄H₄N)⁺-N-Bu Me(CH₂)₇CH₂OSO₃⁻ 07-0150 [BMIM] [OctSO₄] 5g
 [Me-N⁺(C₄H₄N)⁺-N-Bu]₃ PO₄³⁻ 07-0160 [BMIM]₃ [PO₄] 5g	 [Me-N⁺(C₄H₄N)⁺-N-Bu]₃ BF₄⁻ 07-0170 [BMIM] [BF₄] 5g	

IONIC LIQUID KITS - Ionic Liquid Kit 3: CYPHOS® IL Phosphonium Salt Kit

96-6520 Ionic Liquid Kit 3: CYPHOS® IL Phosphonium Salt Kit

Components also available for individual sale.

Contains the following:

15-6370	Trihexyl(tetradecyl)phosphonium bis(trifluoromethanesulfonyl)amide, min. 97% CYPHOS® IL 109 (460092-03-9)	10g
15-6374	Trihexyl(tetradecyl)phosphonium bis(2,4,4-trimethylpentyl)phosphinate, min. 95% CYPHOS® IL 104 (465527-59-7)	10g
15-6378	Trihexyl(tetradecyl)phosphonium bromide, min. 95% CYPHOS® IL 102 (654057-97-3)	10g
15-6382	Trihexyl(tetradecyl)phosphonium chloride, min. 93% CYPHOS® IL 101 (258864-54-9)	10g
15-6386	Trihexyl(tetradecyl)phosphonium decanoate, min. 95% CYPHOS® IL 103 (465527-65-5)	10g
15-6390	Trihexyl(tetradecyl)phosphonium dicyanamide, min. 95% CYPHOS® IL 105	10g
15-6394	Trihexyl(tetradecyl)phosphonium hexafluorophosphate, min. 98% CYPHOS® IL 110 (374683-44-0)	10g

CYPHOS® IL Registered trademark of Cytec.

References:

1. The Strem Chemiker, Vol. XX, No. 1, 2003 for technical note.

LIGAND KITS - AntPhos and WingPhos Kit

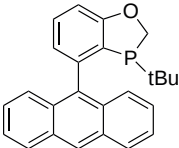
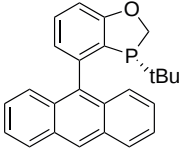
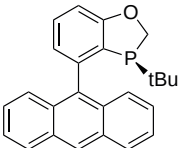
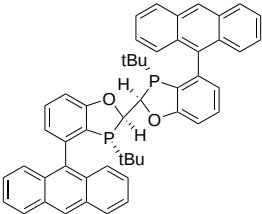
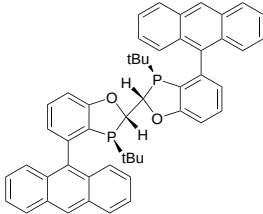
96-3810 AntPhos and WingPhos Kit

Sold in collaboration with Zejun for research purposes only.

Patents ZL201310020371.1, CN 201610056390.

Components also available for individual sale.

Contains the following:

 15-1960 rac-AntPhos 25mg	 15-1963 [(R)-AntPhos] 25mg	 15-1967 [(S)-AntPhos] 25mg
 15-1970 [(2R,2'R,3R,3'R)-WingPhos] 25mg	 15-1975 [(2S,2'S,3S,3'S)-WingPhos] 25mg	

LIGAND KITS - 1,1'-Bis(dialkyl/diarylphosphino)ferrocene Ligand Kit

96-3730

1,1'-Bis(dialkyl/diarylphosphino)ferrocene Ligand Kit

Components also available for individual sale.

Contains the following:

26-0150 DTBPF	500mg	26-0155	500mg	26-0270 DPPF	1g	26-0275 DiIPPf	500mg
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LIGAND KITS - Buchwald Biaryl Phosphine Ligand Master Kit

96-5500

Buchwald Biaryl Phosphine Ligand Master Kit for Aromatic Carbon-Heteroatom Bond Formation, Suzuki Coupling and Negishi Cross-coupling

For aromatic carbon-heteroatom bond formation and Suzuki Coupling.

Patents: US 6,395,916, US 6,307,087

Components also available for individual sale.

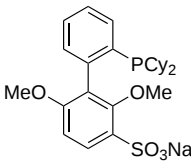
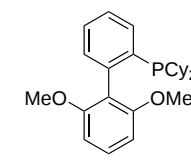
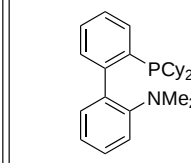
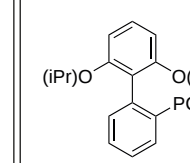
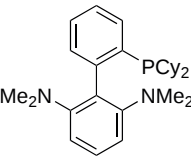
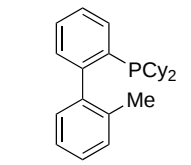
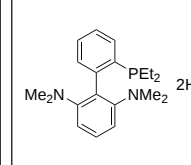
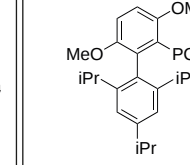
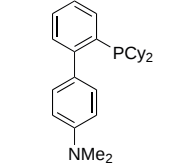
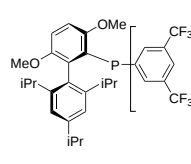
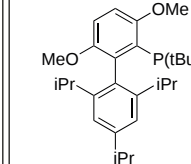
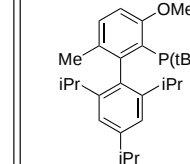
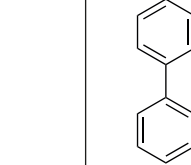
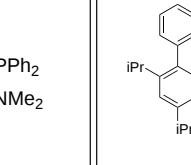
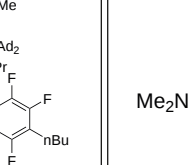
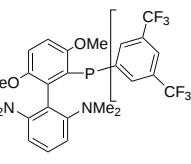
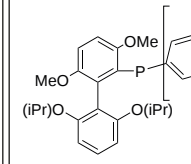
Contains the following:

15-1043 TrixiePhos	250mg	15-1045 JohnPhos	500mg	15-1048 tBuDavePhos	500mg	15-1049 t-BuMePhos	500mg
15-1051 Me4-t-BuXPhos	250mg	15-1052 t-BuXphos	500mg	15-1063	250mg	15-1105 VPhos	250mg
15-1125 PhCPhos	100mg	15-1135 (XPhos-SO₃Na)	100mg	15-1138 AdBrettPhos	100mg	15-1140 CyJohnPhos	1g

LIGAND KITS - Buchwald Biaryl Phosphine Ligand Master Kit

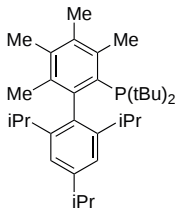
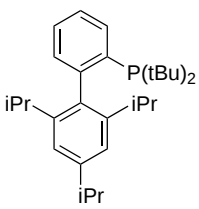
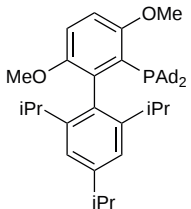
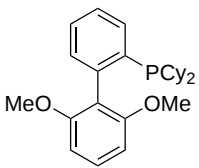
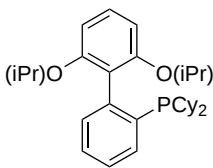
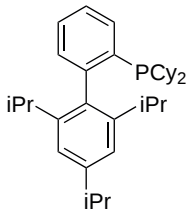
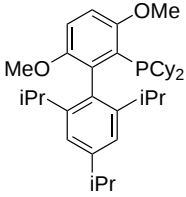
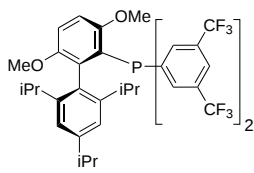
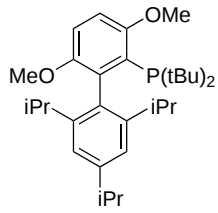
96-5500
(continued)

Buchwald Biaryl Phosphine Ligand Master Kit for Aromatic Carbon-Heteroatom
Bond Formation, Suzuki Coupling and Negishi Cross-coupling

 15-1142 500mg (water soluble SPhos)	 15-1143 500mg SPhos	 15-1145 500mg DavePhos	 15-1146 1g RuPhos
 15-1147 250mg CPhos	 15-1148 500mg MePhos	 15-1151 100mg EtCPhos	 15-1152 250mg BrettPhos
 15-1154 250mg	 15-1157 100mg JackiePhos	 15-1164 100mg t-BuBrettPhos	 15-1168 100mg RockPhos
 15-1745 500mg PhDavePhos	 15-2065 100mg AlPhos	 15-3010 250mg (t-Bu)PhCPhos	
	 15-3015 100mg	 15-3020 250mg	

LIGAND KITS - Buchwald Biaryl Phosphine Ligand Mini Kit 1

96-5485 Buchwald Biaryl Phosphine Ligand Mini Kit 1 for Aromatic Carbon-Heteroatom Bond Formation, Suzuki Coupling and Negishi Cross-coupling
 For aromatic carbon-heteroatom bond formation and Suzuki Coupling.
 Patents: US 6,395,916, US 6,307,087
 Components also available for individual sale. Contains the following:

 15-1051 Me₄ t-BuXPhos 250mg	 15-1052 t-BuXPhos 500mg	 15-1138 AdBrettPhos 100mg
 15-1143 SPhos 500mg	 15-1146 RuPhos 1g	 15-1149 XPhos 500mg
 15-1152 BrettPhos 250mg	 15-1157 JackiePhos 100mg	 15-1164 t-BuBrettPhos 100mg

LIGAND KITS - Buchwald Biaryl Phosphine Ligand Mini Kit 2

96-5490

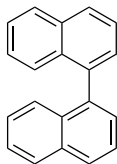
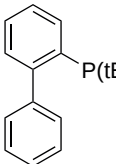
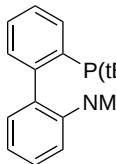
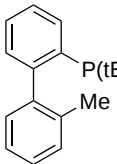
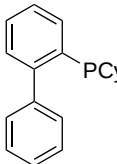
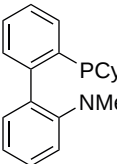
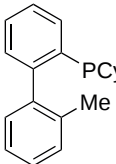
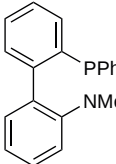
Buchwald Biaryl Phosphine Ligand Mini Kit 2 for Aromatic Carbon-Heteroatom Bond Formation, Suzuki Coupling and Negishi Cross-coupling

For aromatic carbon-heteroatom bond formation and Suzuki Coupling.

Patents: US 6,395,916, US 6,307,087

Components also available for individual sale.

Contains the following:

 15-1043 TrixiePhos 250mg	 15-1045 JohnPhos 500mg	 15-1048 tBuDavePhos 500mg
 15-1049 t-BuMePhos 500mg	 15-1140 CyJohnPhos 1g	 15-1145 DavePhos 500mg
 15-1148 MePhos 500mg	 15-1745 PhDavePhos 500mg	

LIGAND KITS - Buchwald Biaryl Phosphine Ligand Mini Kit 3

96-5495

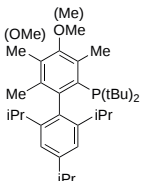
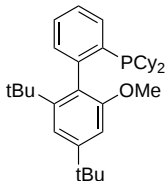
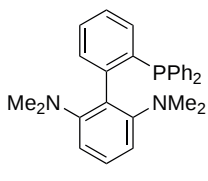
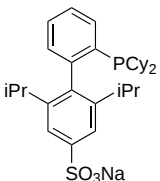
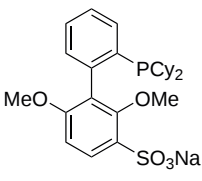
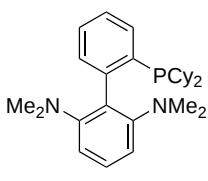
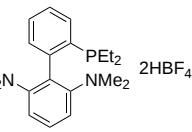
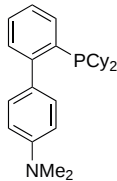
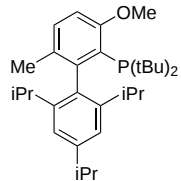
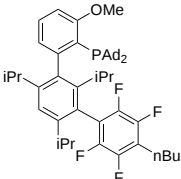
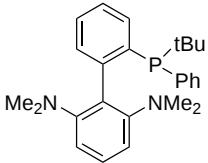
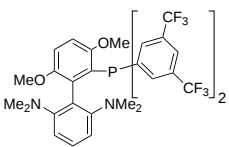
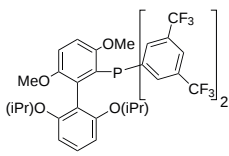
NEW

Buchwald Biaryl Phosphine Ligand Mini Kit 3 for Aromatic Carbon-Heteroatom Bond Formation, Suzuki Coupling and Negishi Cross-coupling

For aromatic carbon-heteroatom bond formation and Suzuki Coupling.

Patents: US 6,395,916, US 6,307,087.

Components also available for individual sale. Contains the following:

 15-1063 250mg	 15-1105 VPhos 250mg	 15-1125 PhCPhos 100mg
 15-1135 (XPhos-SO₃Na) 100mg	 15-1142 (water soluble SPhos) 500mg	 15-1147 CPhos 250mg
 15-1151 EtCPhos 100mg	 15-1154 250mg	 15-1168 RockPhos 100mg
 15-2065 AlPhos 100mg	 15-3010 (t-Bu)PhCPhos 250mg	 15-3015 100mg
 15-3020 250mg		

LIGAND KITS - DSM MonoPhos™ Ligand Kit

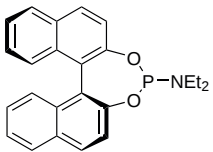
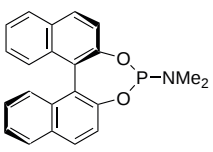
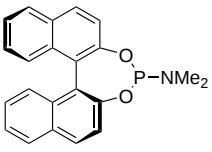
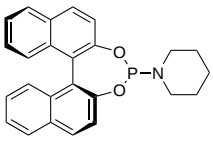
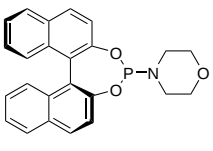
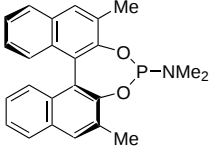
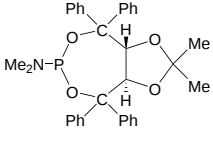
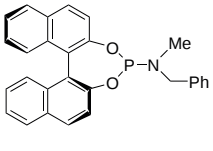
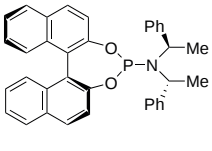
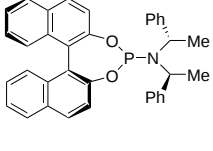
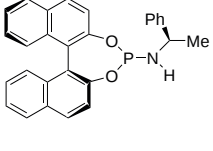
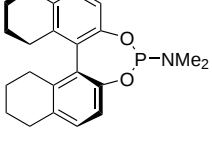
96-5650

DSM MonoPhos™ Ligand Kit

For asymmetric catalytic hydrogenations and other transformations.

Sold in collaboration with DSM for research purposes only.

Components also available for individual sale. Contains the following:

 15-1231 250mg	 15-1232 1g	 15-1233 1g
 15-1234 100mg	 15-1235 100mg	 15-1255 100mg
 15-1505 100mg	 15-1510 100mg	 15-1520 100mg
 15-1521 100mg	 15-1525 100mg	 15-3495 100mg

LIGAND KITS - Garphos™ Ligand Kit

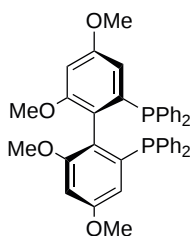
96-4100

Garphos™ Ligand Kit

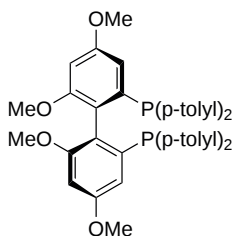
Sold in collaboration with KCT. Patent US App No. 61/381,493.

Components also available for individual sale.

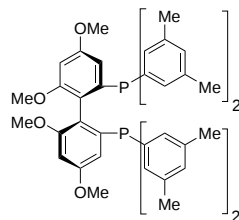
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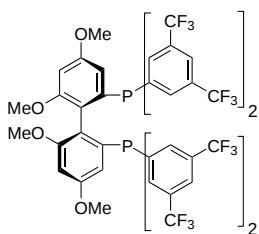
15-1653 100mg
(R)-Ph-Garphos™
15-1654
(S)-Ph-Garphos™



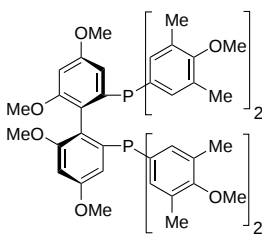
15-1657 100mg
(R)-Tol-Garphos™
15-1658
(S)-Tol-Garphos™



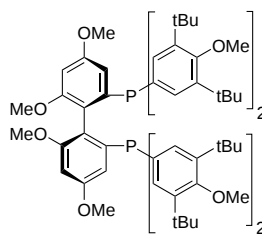
15-1661 100mg
(R)-Xyl-Garphos™
15-1662
(S)-Xyl-Garphos™



15-1663 100mg
(R)-BTfM-Garphos™
15-1664
(S)-BTfM-Garphos™



15-1666 100mg
(R)-DMM-Garphos™
15-1667
(S)-DMM-Garphos™



15-1672 100mg
(R)-DTBM-Garphos™
15-1673
(S)-DTBM-Garphos™

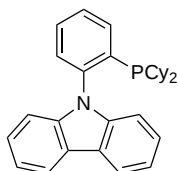
LIGAND KITS - PhenCar-Phos Ligand Kit

96-3780

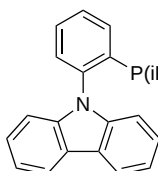
PhenCar-Phos Ligand Kit

Components also available for individual sale.

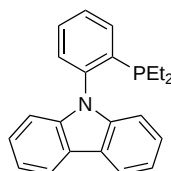
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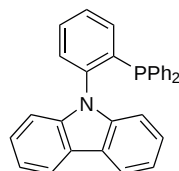
15-0445 250mg
PhenCar-Phos



15-0493 250mg
i-Pr PhenCar-Phos



15-0496 100mg
Et PhenCar-Phos



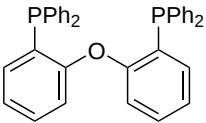
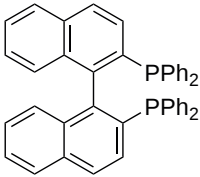
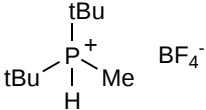
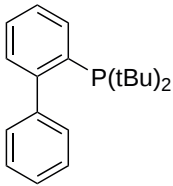
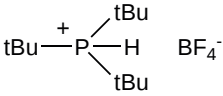
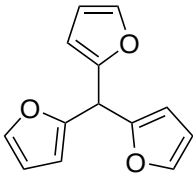
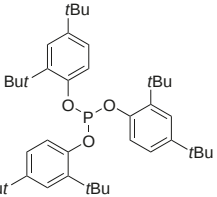
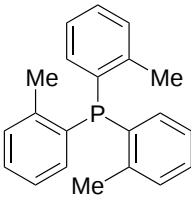
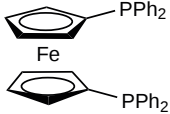
15-0498 250mg
Ph PhenCar-Phos

LIGAND KITS - Phosphine Ligand Kit

96-1650

Phosphine Ligand Kit for Palladium-Catalyzed Carbon-Carbon and Carbon-Heteroatom Bond Formation

For Palladium-catalyzed carbon-carbon and carbon-heteroatom bond formation. Components also available for individual sale. Contains the following:

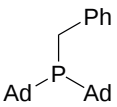
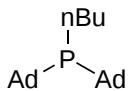
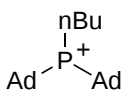
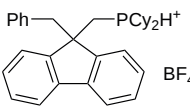
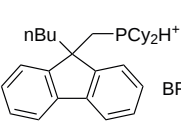
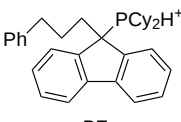
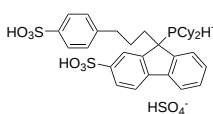
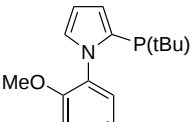
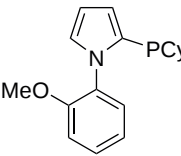
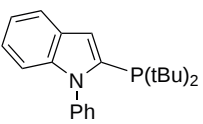
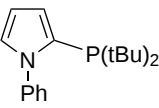
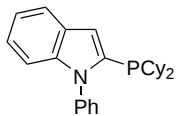
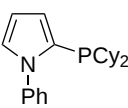
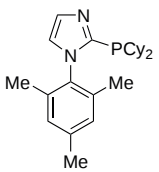
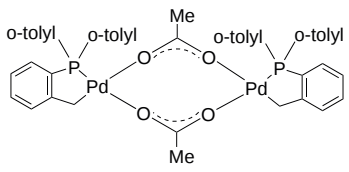
 15-0380 DPEphos 5g	 15-0433 rac-BINAP 1g	 15-1023 1g
 15-1045 JohnPhos 500mg	 15-6000 1g	 15-6372 500mg
 15-7720 10g	 15-8050 5g	 26-0270 DPPF 1g

LIGAND KITS - Solvias cataCXium® Ligand Kit

96-6651

Solvias cataCXium® Ligand Kit for C-X coupling reactions

For C-X coupling reactions. Sold in collaboration with Solvias for research purposes only.
Components also available for individual sale. Contains the following:

 15-0038 500mg [cataCXium® ABn]	 15-0483 1g [cataCXium® A]	 15-0495 250mg [cataCXium® AHI]	 15-1072 500mg [cataCXium® FBn]
 15-1074 500mg [cataCXium® FBu]	 15-1076 500mg [cataCXium® FPrPh]	 15-1078 500mg [cataCXium® FSulf]	 15-2975 500mg [cataCXium® POMeB]
 15-2980 500mg [cataCXium® POMeCy]	 15-3550 500mg [cataCXium® PlntB]	 15-3600 500mg [cataCXium® PtB]	 15-3605 500mg [cataCXium® PlnC]
 15-3610 500mg [cataCXium® PCy]	 15-6362 500mg [cataCXium® PlCy]	 46-0290 250mg [cataCXium® C]	

LIGAND KITS - Solvias Josiphos Ligand Kit

96-3650

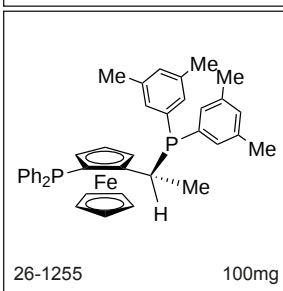
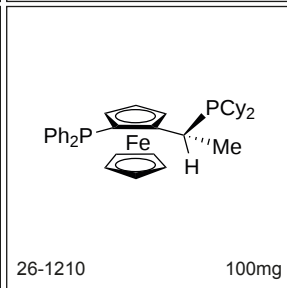
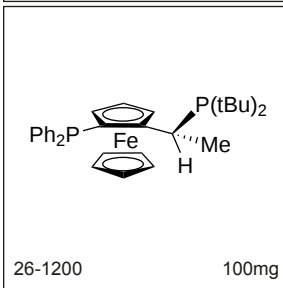
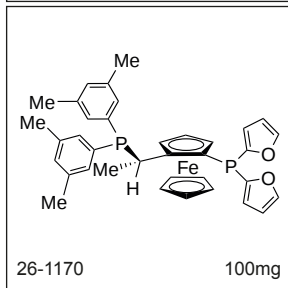
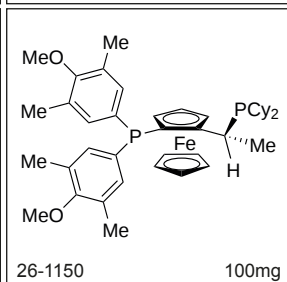
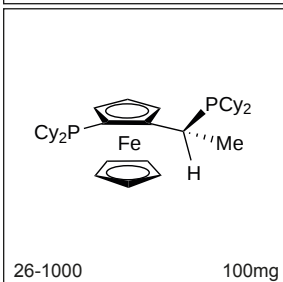
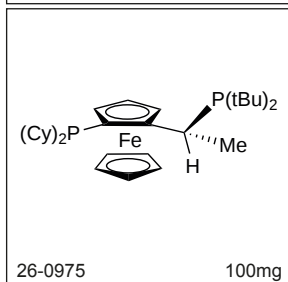
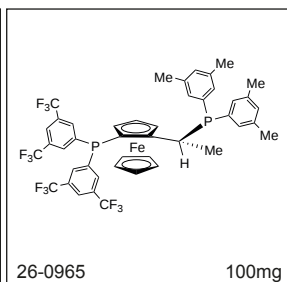
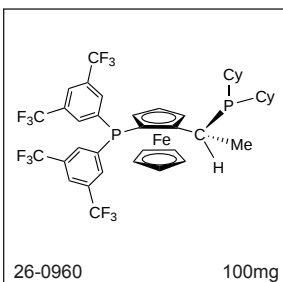
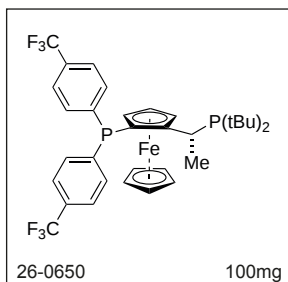
Solvias Josiphos Ligand Kit

For asymmetric catalytic hydrogenations and other transformations.

Sold in collaboration with Solvias for research purposes only.

Components also available for individual sale.

Contains the following:



LIGAND KITS - Solvias MandyPhos™ Ligand Kit

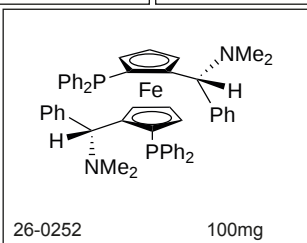
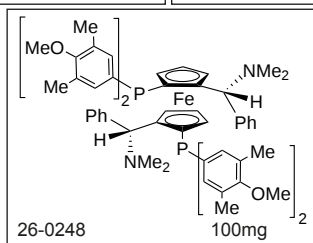
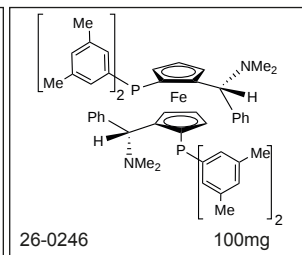
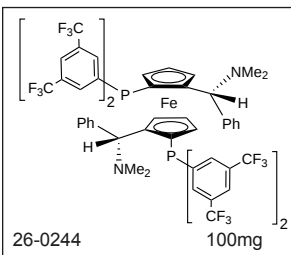
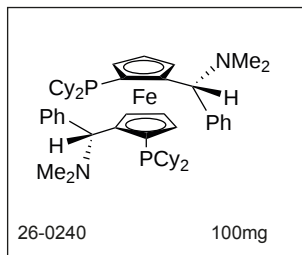
96-3652

Solvias MandyPhos™ Ligand Kit

For asymmetric catalytic hydrogenations and other transformations.

Sold in collaboration with Solvias for research purposes only.

Components also available for individual sale. Contains the following:



LIGAND KITS - Solvias Walphos Ligand Kit

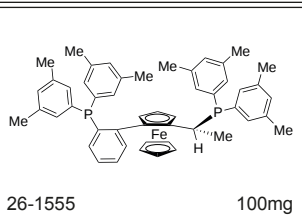
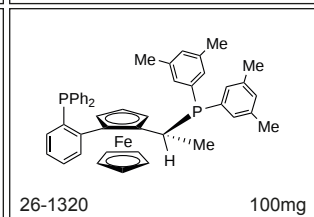
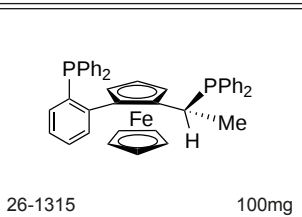
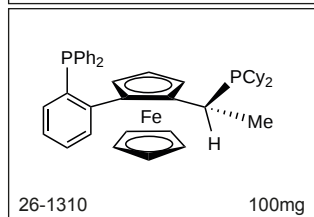
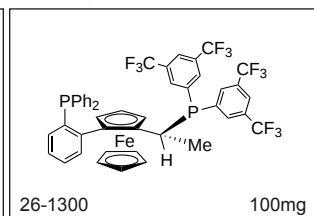
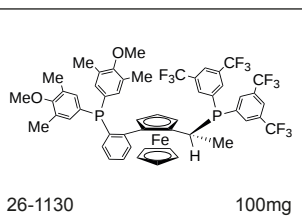
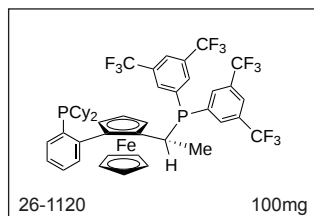
96-3651

Solvias Walphos Ligand Kit

For asymmetric catalytic hydrogenations and other transformations.

Sold in collaboration with Solvias for research purposes only.

Components also available for individual sale. Contains the following:



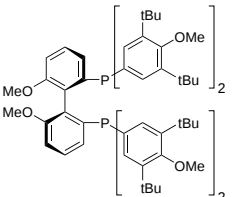
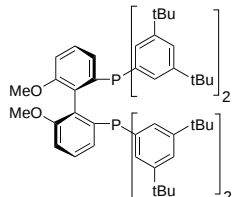
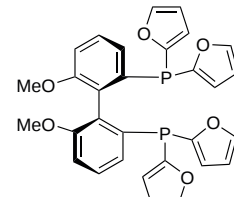
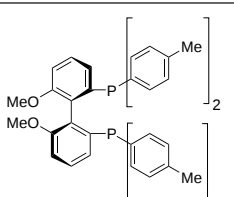
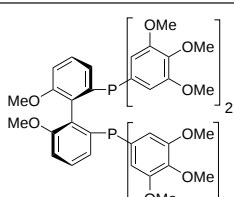
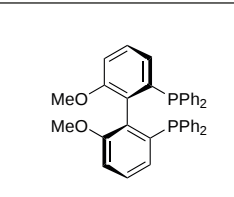
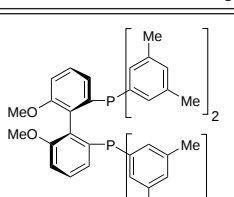
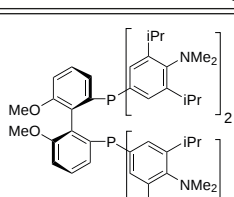
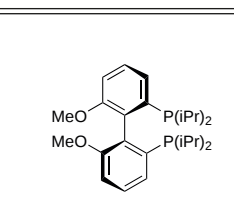
LIGAND KITS - Solvias (R)-MeO-BIPHEP Ligand Kit

96-3655

Solvias (R)-MeO-BIPHEP Ligand Kit

Sold in collaboration with Solvias for research purposes only.

Components also available for individual sale. Contains the following:

	15-0042	100mg
	15-0044	100mg
	15-0112	100mg
	15-0156	100mg
	15-0158	100mg
	15-0178	100mg
	15-0488	100mg
	15-0652	100mg
	15-0654	100mg

LIGAND KITS - Solvias (S)-MeO-BIPHEP Ligand Kit

96-3656

Solvias (S)-MeO-BIPHEP Ligand Kit

Sold in collaboration with Solvias for research purposes only.

Components also available for individual sale. Contains the following:

15-0043	(S)-(+)-2,2'-Bis[di(3,5-di-t-butyl-4-methoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (910134-30-4)	100mg
15-0045	(S)-(-)-2,2'-Bis[di(3,5-di-t-butylphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (167709-31-1)	100mg
15-0113	(S)-(-)-2,2'-Bis(di-2-furanylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (145214-59-1)	100mg
15-0157	(S)-(-)-2,2'-Bis(di-p-tolylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (133545-25-2)	100mg
15-0159	(S)-(-)-2,2'-Bis[di(3,4,5-trimethoxyphenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (256235-61-7)	100mg
15-0179	(S)-(-)-2,2'-Bis(diphenylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (S)-MeO-BIPHEP (133545-17-2)	100mg
15-0489	(S)-(-)-2,2'-Bis[di(3,5-xylyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (362634-22-8)	100mg
15-0653	(S)-(+)-2,2'-Bis[di(3,5-di-i-propyl-4-dimethylaminophenyl)phosphino]-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (919338-66-2)	100mg
15-0655	(S)-(-)-2,2'-Bis(di-i-propylphosphino)-6,6'-dimethoxy-1,1'-biphenyl, min. 97% (150971-43-0)	100mg

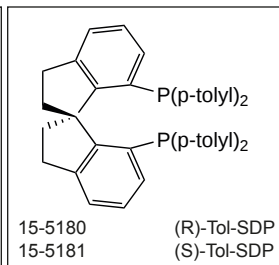
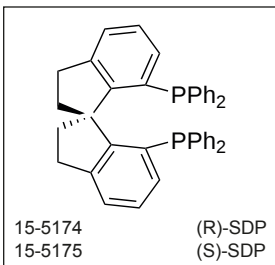
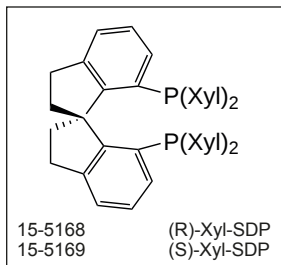
LIGAND KITS - Spiro Biphosphine Ligand Kit

96-0060

Spiro Biphosphine Ligand Kit

Components also available for individual sale.

Contains the following:



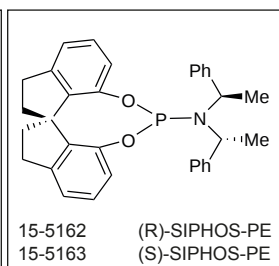
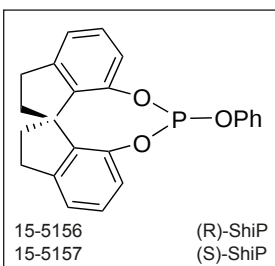
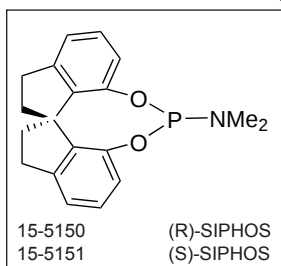
LIGAND KITS - Spiro Monophosphite & Monophosphoramidite Ligand Kit

96-0065

Spiro Monophosphite and Monophosphoramidite Ligand Kit

Components also available for individual sale.

Contains the following:



LIGAND KITS - Takasago BINAP Ligand Kit

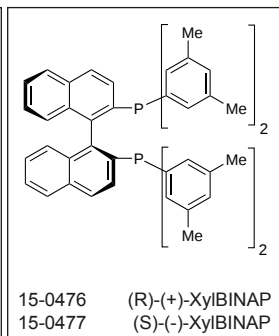
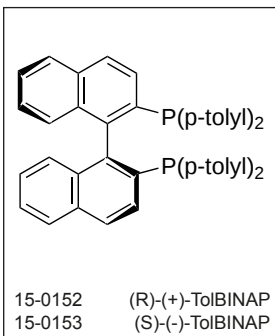
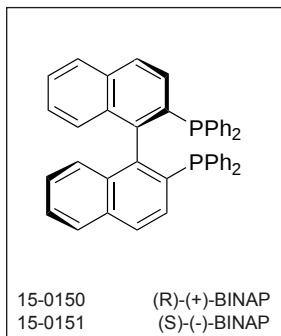
96-6950

Takasago BINAP Ligand Kit

Manufactured under license of Takasago patent.

Components also available for individual sale.

Contains the following:



LIGAND KITS - Takasago SEGPPOS® Ligand Kit

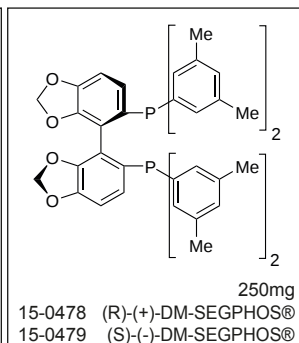
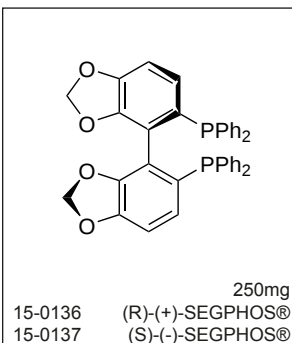
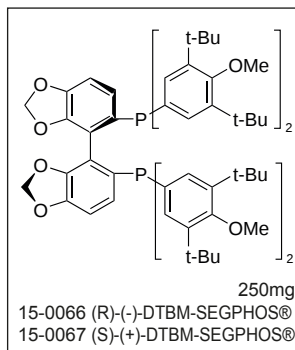
96-6900

Takasago SEGPPOS® Ligand Kit

Manufactured under license of Takasago patent.

Components also available for individual sale.

Contains the following:



LIGAND KITS - UREAphos & METAMORPhos Ligand Kit

96-3740

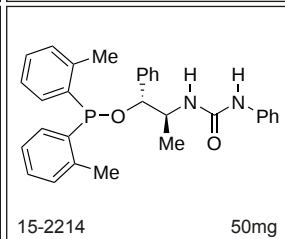
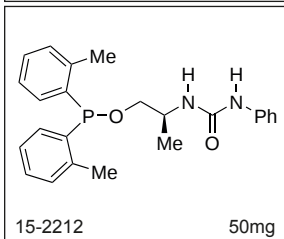
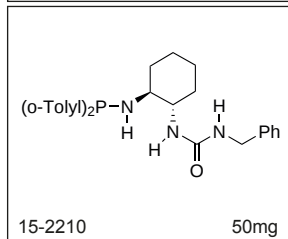
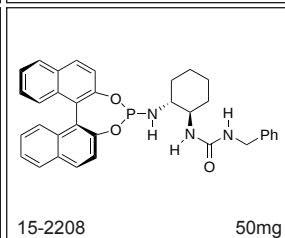
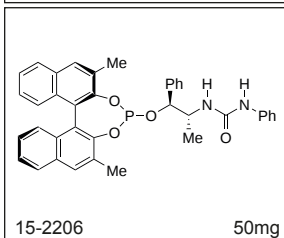
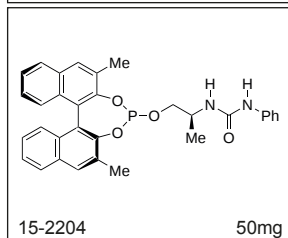
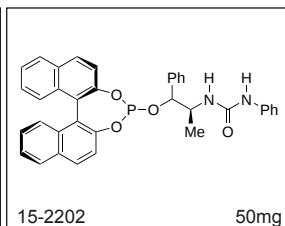
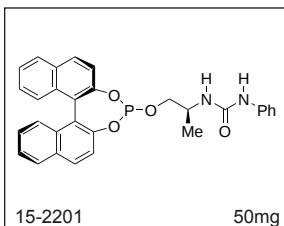
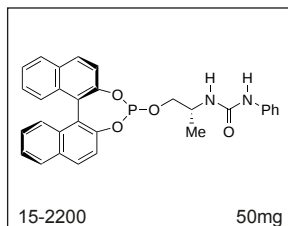
UREAphos and METAMORPhos Ligand Kit for Asymmetric Hydrogenation

Sold under license from InCatT for research purposes only.

WO2004/103559, WO2009/065853

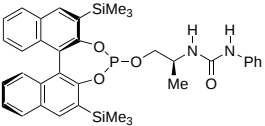
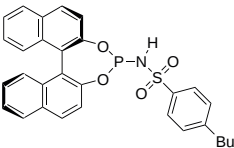
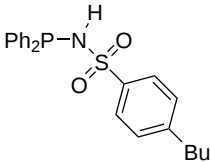
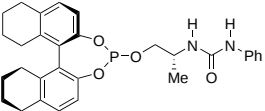
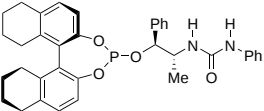
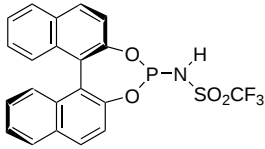
Components also available for individual sale.

Contains the following:



LIGAND KITS - UREAphos & METAMORPhos Ligand Kit

96-3740 UREAphos and METAMORPhos Ligand Kit for Asymmetric Hydrogenation
(continued)

 15-2216 50mg	 15-2218 50mg	 15-2220 50mg
 15-2222 50mg	 15-2224 50mg	 15-2228 50mg

METAL SCAVENGING KITS - BASF Metals Scavenging Agent Kit (MSA Kit)

96-6700 BASF Metals Scavenging Agent Kit (MSA Kit)
Sold in collaboration with BASF for research purposes only. .
Components also available for individual sale. Contains the following:

06-0805	Metals scavenging agent, Phosphotungstic acid modified activated carbon (BASF MSA-FC C-1) (7440-44-0)	10g
13-6300	Metals scavenging agent, Phosphotungstic acid modified alumina (BASF MSA-FC Al-1) (1344-28-1)	10g
14-4353	Metals scavenging agent, Mercaptopropyl modified silica (BASF MSA-FC Si-3) (112926-00-8)	10g

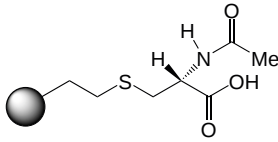
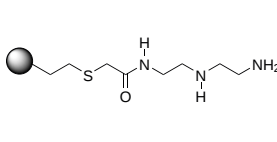
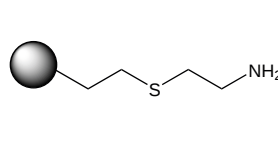
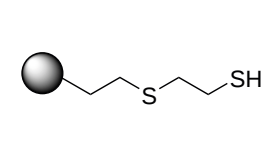
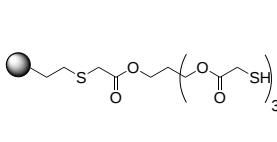
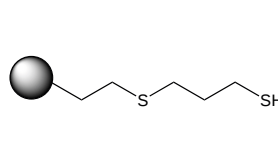
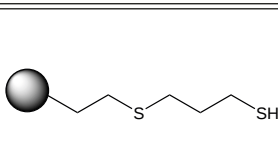
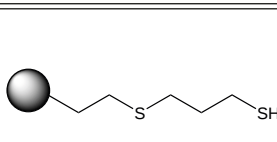
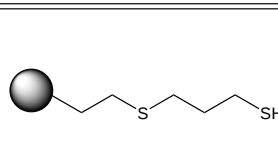
METAL SCAVENGING KITS - PhosphonicS Metals Scavenging Agent Kit

96-6750

PhosphonicS Metals Scavenging Kit

Sold in collaboration with PhosphonicS Ltd. for research purposes only.

Components also available for individual sale. Contains the following:

 16-0200 (PhosphonicS SCYT1) 10g	 16-0210 (PhosphonicS STA3) 10g	 16-0215 (PhosphonicS SEA) 10g
 16-0650 (PhosphonicS SEM26) 10g	 16-1540 (PhosphonicS SET) 10g	 16-1700 (PhosphonicS SPM36) 10g
 16-1702 (PhosphonicS SPM36f) 10g	 16-1704 (PhosphonicS SPM32f) 10g	 16-1706 (PhosphonicS SPM32) 10g

Metal scavengers are increasingly used as an effective way to solve metal removal problems associated with Active Pharmaceutical Ingredients (API's) and synthetic intermediates. This is an often complex technical challenge, influenced by a number of factors including the significant structural variations with API's, the polar functional groups which APIs tend to contain, the environment (solvent and pH) and potential incompatibilities within the API. PhosphincS has designed a portfolio of silica-based materials containing a diverse range of functional groups to address effective metal scavenging.

Properties of PhosphonicS' Broad Portfolio of Metal Scavengers

- High affinity for a wide range of metals, in different oxidation states
- Fast kinetics - highly active at ambient temperatures
- High selectivity for the metal, meaning minimal loss of the API/compound
- Broad solvent and pH compatibility with both organic and aqueous formulations, reducing the requirements of time-consuming and costly solvent switches
- No swelling of the materials are required
- Excellent stability - thermal, physical, chemical and mechanical
- Very high purity - eliminating issues of extractable impurities
- Enhanced performance, due to multiple functional groups and higher effective loadings
- Metal recycling options
- Availability on process scale

Performance Benefits from using PhosphonicS' Metal Scavengers

- **Faster:** purification, batch processing, problem-solving, market introduction
- **Reduced:** development time, valuable API losses, total manufacturing costs, environmental burden
- **Enhanced:** process, productivity, compliance

OTHER KITS - Long-Chain n-Alkylphosphonic Acid Kit

96-1525

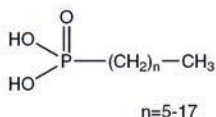
Long-Chain n-Alkylphosphonic Acid Kit

Components also available for individual sale. Contains the following:

15-0958	n-Decylphosphonic acid, min. 97% (6874-60-8)	1g
15-1835	n-Dodecylphosphonic acid, min. 97% DDPA (5137-70-2)	1g
15-2400	n-Hexadecylphosphonic acid, min. 97% HDPa (4721-17-9)	1g
15-2410	n-Hexylphosphonic acid, min. 97% HPA (4721-24-8)	1g
15-3510	n-Octadecylphosphonic acid, min. 97% ODPA (4724-47-4)	1g
15-3520	n-Octylphosphonic acid, min. 97% OPA (4724-48-5)	1g
15-5145	n-Tetradecylphosphonic acid, min. 97% TDPA (4671-75-4)	1g

General Use:

Linear alkyl Phosphonic acids and their phosphonate salts are surfactants because of their classic bifunctional chemical structure, $RP(O)(OH)_2$, consisting of both non-polar organic hydrophobic groups and anionic inorganic hydrophilic groups. Like the related alkyl sulfonates, they are used as detergents, dispersants, emulsifiers, and chelating agents. Alkyl phosphonic acids are typically sparingly soluble in both organic solvents and water, but become more soluble in water when neutralized to phosphonates at neutral to high pH.



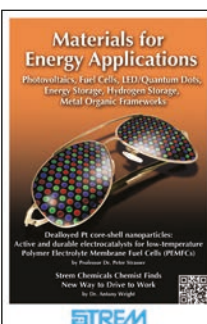
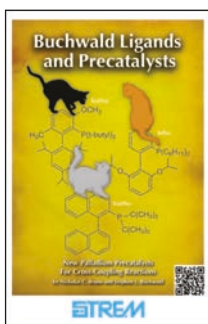
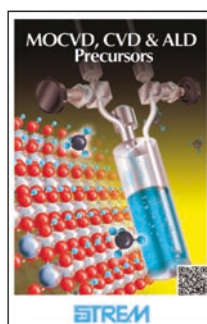
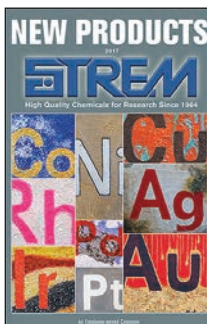
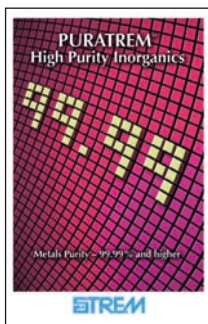
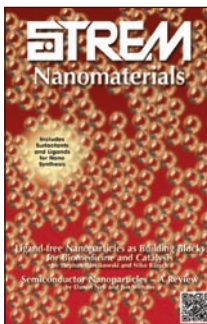
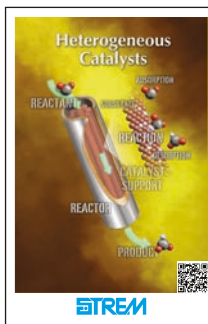
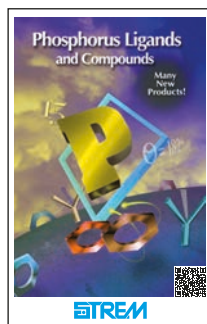
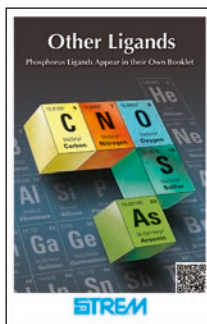
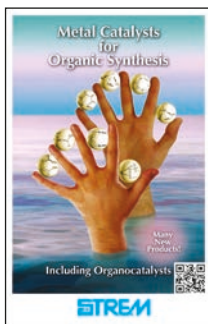
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