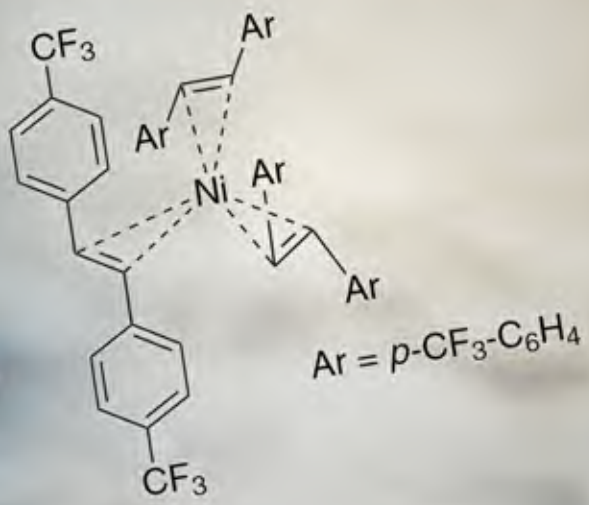
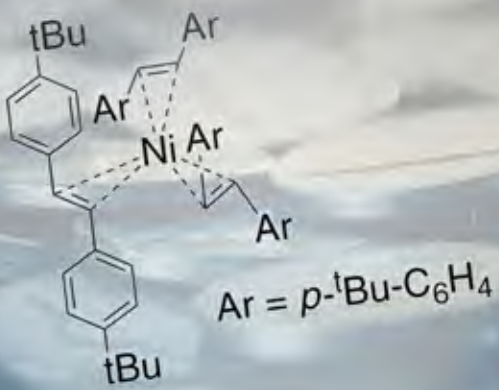
A Publication of Ascensus Specialties

THE STREM CHEMIKER

Vol. XXXII No.1 October, 2021





Air-Stable tris-(stilbene)Ni(0) Complexes

by Dr. Josep Cornella and Rakan Saeb

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American Chemical Society Award for Distinguished Service in the Advancement of Inorganic Chemistry	2021	Prof. Kenneth D. Karlin, Johns Hopkins University
	2020	Prof. Bruce E. Bursten, Worcester Polytechnic Institute
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Canadian Society for Chemistry Award for Pure or Applied Inorganic Chemistry	2021	Laura Turculet, MCIC, Dalhousie University
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STREM AN ASCENSUS™ COMPANY
The Strem Chemiker
Vol. XXXII No.1
October, 2021

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Glossary of Terms

$[\alpha]_D$	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 of Hg (Torr), 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 Chromotography
v.p.	Vapor pressure mm of Hg (Torr)
xtl.	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

Biographical Sketches

Dr. Josep Cornella

Josep Cornella (Pep) was born in La Bisbal del Penedès, a small town in south Catalunya. He graduated in chemistry in 2008 from the University of Barcelona and carried MSc studies in the Department of Organic Chemistry studying the chemistry of allylboron reagents. After completing his masters thesis, he moved to the United Kingdom to pursue doctoral studies in the group of Prof. Igor Larrosa (QMUL). In early 2012, he earned his PhD working on the use of aromatic carboxylic acids as aryl donors in metal-catalyzed decarboxylative reactions. He then moved back to Catalunya, where he joined the group of Prof. Ruben Martin (ICIQ) with a COFUND Fellowship and later as Marie Curie Postdoctoral Fellow. There, he developed novel transformations involving Ni-catalyzed C–O bond activation and carbon dioxide insertion into organic molecules. In 2015, Pep obtained a Beatriu de Pinós Fellowship to carry out further postdoctoral studies in the group of Prof. Phil S. Baran at The Scripps Research Institute, California, USA. During this time, he worked on the discovery and implementation of new transformations based on the concept of "redox-active esters" as practical and readily available partners for Ni- and Fe-catalyzed C–C bond forming reactions. In summer 2017, he was selected as Max Planck Research Group Leader (MPRGL) to create and lead the Laboratory for Sustainable Catalysis at the Max-Planck-Institut für Kohlenforschung (Germany). His work focuses on the development of sustainable catalytic strategies based on the design of ligands, reagents and catalysts to streamline organic synthesis.

Rakan Saeb

Rakan grew up in Munich and studied Chemistry at the Ludwig Maximilian University of Munich (LMU Munich). He carried out undergraduate research in the group of Dr. Oliver Thorn-Seshold, working on the synthesis of novel topoisomerase inhibitors, as well as in the group of Prof. Paul Knochel, studying the chemistry of organolithium species. During his undergraduate studies Rakan worked in the biotech company 4SC AG, synthesizing potential drug candidates for cancer treatment. Driven by his interest in organometallic chemistry and catalysis, he joined Dr. Josep Cornella at the Max-Planck-Institut für Kohlenforschung, focusing on studies on Ni(0)-olefin complexes. In 2021 he graduated from LMU Munich, obtaining a M.Sc. in chemistry and is currently pursuing PhD studies with Dr. Cornella, further investigating the chemistry of Ni(0)-olefin complexes.

Air-Stable *tris*-(stilbene)Ni(0) Complexes[1]

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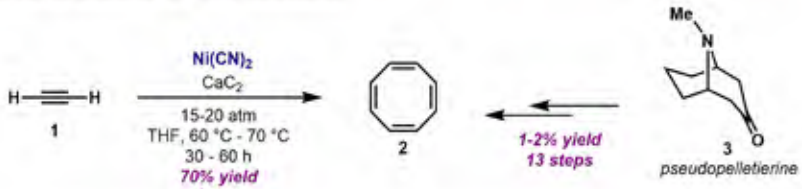
Germany

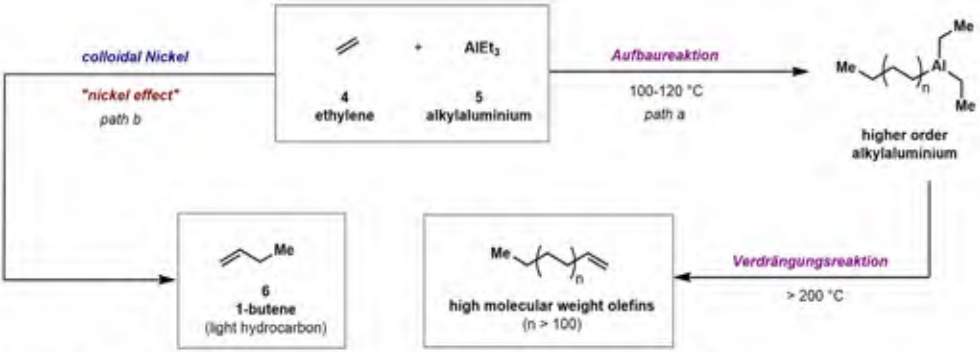
Ni-olefin chemistry: a brief historical perspective

In 1897, Sabatier and Senderens reported on the gas-phase hydrogenolysis[2] and hydrogenation[3] of substances aided by nickel (Ni) salts, a feature considered as the beginning of Ni catalysis. Despite the power of this seminal milestone, the application of Ni in the context of organic molecules remained underexplored for several years. In a remarkable example, Reppe reported on the tri- and tetramerization of acetylene (**1**) to generate benzene[4] and COT (cyclooctatetraene, **2**),[5] respectively. Up until then, the synthesis of tetraene **2** had been limited to the modification of *pseudopelletierine* (**3**), a naturally occurring compound obtained from the root-bark of the pomegranate tree. At that time, the synthesis of COT required a 13-step sequence, affording an overall yield of 1-2%.[6] Yet, the application of $Ni(CN)_2$ on simple acetylene (**1**), led to the synthesis of COT in an outstanding 70% yield in one catalytic step (Scheme 1).[5,7] This example illustrates the power of catalysis and highlights the paradigm shift in the construction of organic molecules.



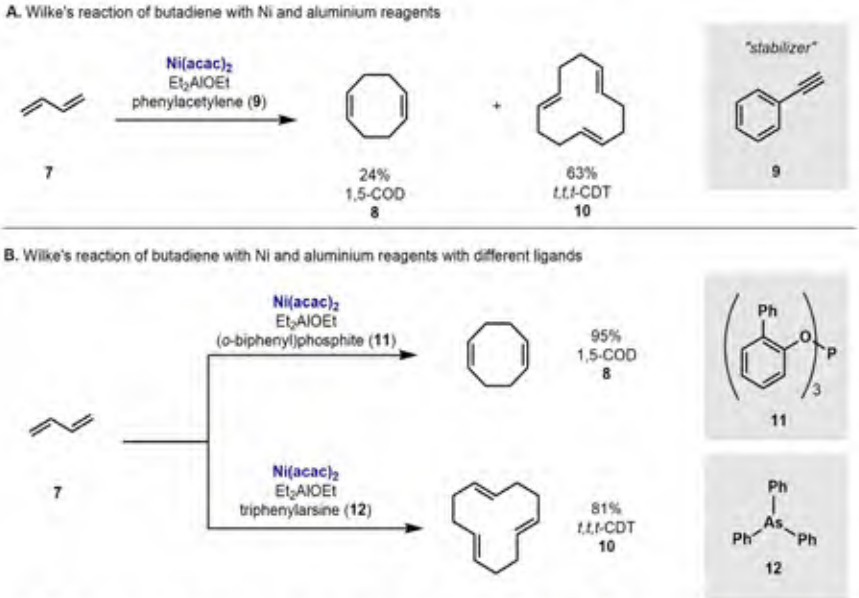
Scheme 1: *The power of catalysis: catalytic preparation of COT vs. traditional synthetic route.*

Although the work of Reppe truly epitomizes the remarkable synergy between alkynes and Ni, the studies on the interactions between Ni and unsaturated compounds by Prof. Karl Ziegler and Prof. Günther Wilke laid the foundations of modern organonickel chemistry and industrial applications thereof. Yet, these contributions initiated with an unexpected and serendipitous observation during the study of the catalytic synthesis of higher molecular weight olefins from simple ethylene (**4**). The process under investigation at that time at the Max-Planck-Institut für Kohlenforschung was the "*Aufbaureaktion*" (addition reaction), where triethylaluminum (**5**) adds into terminal olefins to generate higher order alkylaluminum compounds (Scheme 2). At that time, this process received a lot of attention as it permitted the rapid synthesis of surfactants. Raising the reaction temperature leads to further addition of the alkylaluminium reagent into ethylene ("*Verdrängungsreaktion*", displacement reaction) which, after elimination resulted in the formation of high order α olefins (Scheme 2, path a).[8] In a routine experiment in 1952, Erhard Holzkamp, a researcher working with Ziegler, did not obtain the expected polymerized olefins when heating 100 atm of ethylene with triethylaluminum to 100 °C. Instead, the reaction yielded mainly 1-butene (**6**). This unexpected outcome was systematically repeated by Holzkamp and led to a focused investigation into what were the critical factors that changed the outcome of the well-established "*Verdrängungsreaktion*".[9] Scientists concluded that traces of metallic particles, formed after exhaustive acidic washings of the reactor walls, were responsible for catalyzing the formation of 1-butene. This hypothesis led scientists to examine all elements of the periodic table to identify which element was responsible for the observed reactivity. Finally, it was found that Ni salts were the catalysts responsible for the formation of 1-butene, and this reactivity became known as the "*nickel effect*" (Scheme 2, path b).[9] It is important to mention that the exhaustive scrutiny of a plethora of salts of different elements led to the discovery that titanium/aluminum catalysts efficiently catalyze the polymerization of olefins under mild conditions,[9] an achievement that led Karl Ziegler together with Giulio Natta to be awarded with the Nobel Prize in Chemistry in 1963.[10]



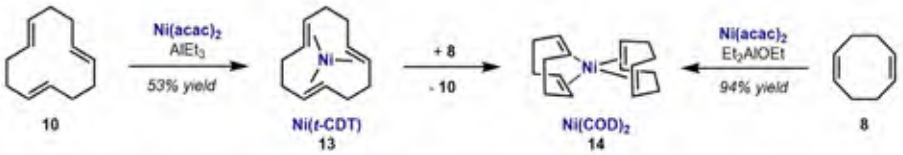
Scheme 2: *The "Aufbaureaktion", the "Verdrängungsreaktion", and the "nickel effect".*

The discovery of the "*nickel effect*" opened up a new field of research and spurred a myriad of programs studying the interaction and reactivity of unsaturated hydrocarbons with nickel compounds.[7, 11-13] Reed reported that Reppe catalysts based on $Ni(CO)_4$ were able to catalyze the dimerization of butadiene (**7**) to generate COD (1,5-cyclooctadiene, **8**) in 30% – 40% yield.[14] However, treatment of other Ni(II) salts with organometallic reagents would lead to the precipitation of metallic nickel with poor catalytic reactivity.[15] Nevertheless, Wilke and co-workers studied further the "*nickel effect*" responsible for the abovementioned dimerization. Hence, when $Ni(acac)_2$ was mixed with phenylacetylene (**9**) (as stabilizer) and reduced with organoaluminum compounds, 24% COD and 63% *t,t,t*-CDT (*trans,trans,trans*-1,5,9-cyclododecatriene, **10**) were obtained (Scheme 3A).[15-16] By altering the compound that stabilizes the reduced nickel, Wilke was capable of shifting the course of the reaction, thus favoring either the trimerization or the dimerization products (Scheme 3B).[15, 17-18] This procedure was of high industrial relevance at that time, as CDT could be used as a starting material for the synthesis of dodecandioic acid and azacyclotridecan-2-one; precursors in the production of polyesters and super polyamides.[19] To the best of our knowledge, this is one of the first examples in which, by changing the "stabilizer" that affects the Ni center, a completely different reaction outcome is obtained.[15, 17-18] We currently understand this as the effect of the ligand on the Ni, which influences the energy of transition states, leading to different reaction pathways.



Scheme 3: ***(A)*** *Dimerization of butadiene by employing the "nickel effect".* ***(B)*** *By altering the stabilizer, t,t,t-CDT and 1,5-COD could be generated with high selectivity and excellent yields.*[15, 17-18]

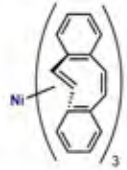
Studies on the mechanism of the cyclooligomerization of butadiene led to the synthesis, isolation and characterization of the 16-electron complex (*trans,trans,trans*-cyclododeca-1,5,9-triene)nickel(0) (Ni(*t*-CDT), **13**), which represents an early example of *homoleptic metal-olefin complexes*.[15-16, 20-21] Addition of 1,5-cyclooctadiene (COD) led to displacement of CDT from the nickel center and concomitant formation of the 18-electron bis(1,5-cyclooctadiene)nickel(0) (Ni(COD)$_2$, **14**). Both complexes turned out to be applicable in the catalytic trimerization of butadiene,[15] and can be easily prepared from Ni(acac)$_2$ and AlR$_3$ (Scheme 4).[16, 21]



Scheme 4: *Synthesis of the first homoleptic Ni(0)-olefin complexes.*[15-16, 20-21]

The facile access to Ni(COD)$_2$ (Strem 28-0010) and Ni(*t*-CDT) laid the foundations for the development of other Ni(0)-olefin complexes and accelerated the research on organonickel chemistry. Since then, the 18-electron Ni(COD)$_2$ has reigned sovereign as a source of Ni(0) due to its relative stability compared to other Ni(0) precursors, and facile exchange of its COD ligands. Despite the vast utility, both, Ni(*t*-CDT) and Ni(COD)$_2$ suffer from instability towards air, thus decomposing rapidly to Ni black when exposed to traces of oxygen. The lability of the COD and *t,t,t*-CDT ligands provides great reactivity for ligand exchange; nevertheless, this property is tightly connected to thermal instability, requiring storage of these compounds under cryogenic conditions to avoid decomposition.[22] Despite the great success of Ni(COD)$_2$ as a Ni(0) source, efforts have been placed in developing alternative Ni(0) sources to circumvent such practical caveats. Over the years, other 18-, 16-, and even 14-electron Ni(0)-olefin complexes were developed. The latter, represent extremely sensitive compounds which have been shown to be highly pyrophoric.[11-12] A solution to their stability is the addition of external σ-donating phosphines[12] or NHC ligands, thus turning an unstable 14-electron Ni(0)-olefin complexes into stable heteroleptic 16-electron complexes.[23] This strategy was recently applied by Montgomery and Hazari, showing that such complexes can be applied as synthons for other bis-olefin-Ni(0) complexes as well as some air-stable pre-catalysts.[24-27] In addition, Ni(II) pre-catalysts bearing various σ-donating ligands,[28-32] NHC-Ni(0)-olefin complexes,[24-27] as well as encapsulation of Ni(COD)$_2$ with paraffin[33] have been developed and represent only a few examples of providing practical access to Ni(0) for catalysis. Some of these pre-catalysts are indeed extremely useful and are now commercially available in the Strem catalog. While being extremely valuable solutions for specific problems, different issues associated with such complexes still exist. For example, these complexes usually lack modularity, and thus restrict extensive ligand survey. Additionally, the necessity of reducing Ni(II) complexes *via* ligand exchange/reduction/disproportionation pathways in order to release a Ni(0) species can result in undefined ligand to metal ratios and formation of undesired salt byproducts.[34] Therefore, a modular Ni(0) source that enables rapid and broad ligand screening and would not suffer from the issues connected to Ni(COD)$_2$ was still highly coveted.

A fundamental discovery in the area of Ni(0)-olefin complexes was reported by Steigerwald and Nuckolls. While searching for a stable tetraalkyl Ni(IV) complex, the authors synthesized a unique 16-electron Ni(0)-olefin complex bearing three (5*Z*,11*E*)-dibenzo[*a*,*e*][8]annulene molecules as ligands (**15**). The authors obtained crystallographic evidence for its connectivity and pointed out a rather exceptional stability towards oxidation under air; however, no catalytic application was reported (Figure 1).[35]



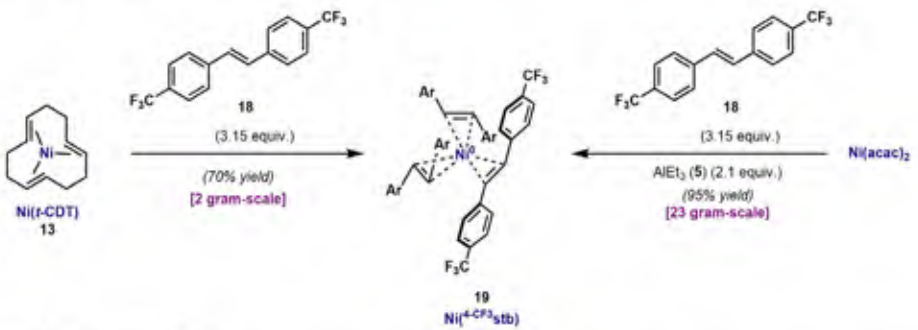
15
Nuckolls' and Steigerwalds complex

***Figure 1**: Air-stable 16-electron Ni(0)-olefin complex.*[35]

Despite this isolated precedent, $Ni(COD)_2$ still dominates the field of organonickel chemistry for 60 years as Ni(0) precursor. Recently, Schrauzer's air-stable Ni(0)-olefin complex Ni(COD)(DQ) (Strem 28-0040) (DQ = duroquinone, **16**)[36] was reported by Engle to be catalytically active in certain catalytic domains where a strongly nucleophilic ligand is present.[37]

Ni(4-CF3stb)3 – 1st generation of air-stable Ni(0)-olefin pre-catalysts

During our investigations on the mechanism of a low-temperature Ni-olefin-Li-catalyzed Kumada-Corriu cross-coupling, the preparation of various 16-electron Ni(0)-olefin complexes was of great interest.[38-39] We turned our attention to a rather forgotten complex reported by Wilke in a patent: Ni(*t*-stb)$_3$ (tris-(*trans*-stilbene)Ni(0), **17**). This complex was originally prepared by an olefin exchange reaction, using Ni(*t*-CDT) and *trans*-stilbene.[21] Similar to Steigerwald and Nuckolls' complex (**15**),[35] **17** exhibited certain stability when exposed to air (6 hours at 25 °C or 3 days at 0 °C without decomposition). Yet, Ni(*t*-stb)$_3$ was temperature sensitive and slow ligand dissociation eventually led to decomposition (<1 week).[22] When trifluoromethyl groups were introduced at the *para*-position of the stilbene (*trans*-1,2-bis(4-trifluoromethyl)phenyl)ethene, $^{4\text{-CF3}}$stb, **18**), Ni($^{4\text{-CF3}}$stb)$_3$ (**19**) was obtained in 70% yield (Scheme 5, left).[22] Surprisingly, Ni($^{4\text{-CF3}}$stb)$_3$ exhibited a remarkable air-stability for several months when kept in a freezer at −18 °C, and could be manipulated at ambient temperature on a benchtop setting for several days before decomposition was observed.[22]



***Scheme 5:** Syntheses of **19**.*

X-ray analysis revealed that, similarly to **15** and **13**, Ni($^{4\text{-CF3}}$stb)$_3$ consists of three olefin ligands wrapped around the Ni center in a propeller-like arrangement, thus rendering a slightly distorted trigonal-planar coordination geometry (Figure 2). Donation of electron density from the Ni center towards the olefin π* orbitals results in an elongation of the stilbene olefin bond lengths (average of 1.389 Å), which coincides with Nuckolls' and Steigerwald's complex (**15**) (average of 1.39 Å)[35] and with Ni(COD)$_2$ (average of 1.39 Å).[22,40] It is noteworthy to point out that Ni($^{4\text{-CF3}}$stb)$_3$ is chiral, resulting in a racemate in the unit cell. With the goal of facilitating the synthesis of **19**, a practical method was developed utilizing the traditional Wilke recipe: reduction of Ni(acac)$_2$ with $AlEt_3$ in the presence of **18** generated 23 g of the complex in high yields in a single run (95%, Scheme 5, right). Besides the X-ray analysis, additional information on the 1:3 metal:ligand ratio of **19** was obtained by elemental analysis, coordination with external ligands as well as by degradation studies. However, no conclusive NMR analysis was obtained for this complex and thus, it could not be discarded that the powder form of the complex consists of alternative coordination modes around the Ni center. Studies toward fully elucidating the structural features of **19** are currently ongoing in our laboratory.[22]

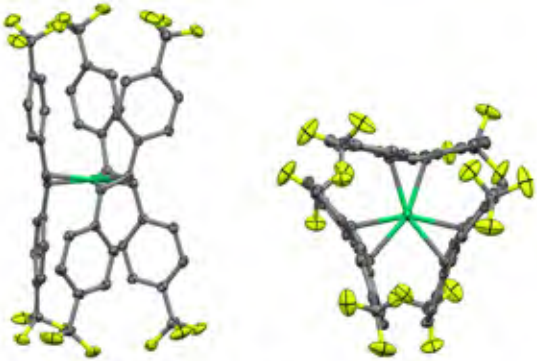
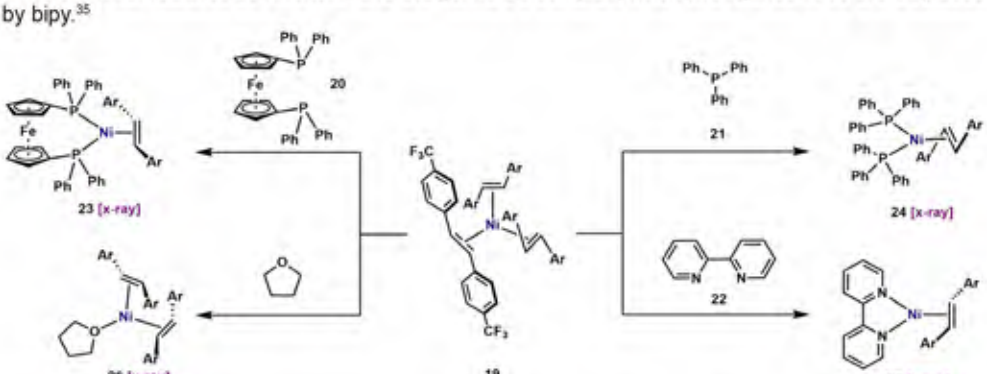


Figure 2: *ORTEP diagram of complex* **19**. *Ar = p-CF_3-C_6H_4. Crystallized from toluene. Two molecules of toluene are present in the unit cell (omitted for clarity). Colors: Green: Ni; Black: C; Yellow: F. Hydrogen atoms were omitted for clarity. Left: side view. Right: top view along the principal axis.*

Ligand exchange studies

In order to evaluate the potential of Ni($^{4\text{-CF3}}$stb)$_3$ as a viable Ni(0) source for catalysis, its ligand exchange abilities were explored. Hence, Ni($^{4\text{-CF3}}$stb)$_3$ was mixed with a set of different ligands commonly applied in nickel catalysis, namely phosphines and diamines. Interestingly, complex **19** underwent smooth ligand exchange with bidentate phosphines such as dppf (1,1'-bis-(diphenylphosphino)ferrocene, **20**),[41-42] monodentate triphenyl phosphine (PPh_3, **21**) and amines such as 2,2'-bipyridine (bipy, **22**) (Scheme 6).[43-44] In all cases, 16-electron complexes were formed bearing one $^{4\text{-CF3}}$stb unit. The products formed were characterized by crystallographic and spectroscopic techniques, and identified as (dppf) Ni($^{4\text{-CF3}}$stb) (**23**), (PPh_3)$_2$Ni($^{4\text{-CF3}}$stb) (**24**) and (bipy)Ni($^{4\text{-CF3}}$stb) (**25**) respectively.[22] The latter example exhibits similar features as Nuckolls' and Steigerwald's complex, when two ligands in **15** are displaced by bipy.[35]



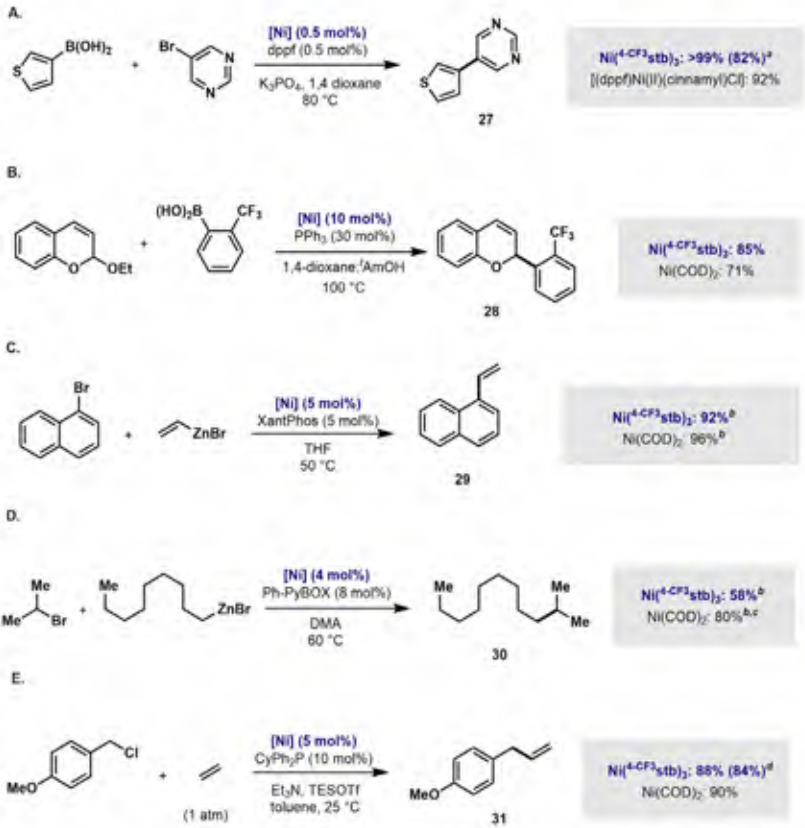
Scheme 6: *Ligand exchange reactions investigated for Ni($^{4\text{-CF3}}$stb)$_3$ with dppf, PPh_3, bipy and THF.*

As shown in Scheme 6, ligand exchange with complex **19** is highly facile for a variety of mono-and bidentate ligands. Yet, such facile ligand exchange turned out to be its Achilles heel: when dissolved in THF at room temperature in the absence of any supporting ligand such as diamine, phosphine or NHC, **19** would rapidly decompose into Ni black. Attempts to intercept intermediates of this decomposition resulted in the isolation of the extremely sensitive compound Ni($^{4\text{-CF3}}$stb)$_2$(THF) (**26**) at a very low temperature, which corresponds to the substitution of one $^{4\text{-CF3}}$stb for a THF molecule. Although still speculative, formation of **26** suggests that decomposition of **19** in THF solutions proceeds via ligand dissociation facilitated by the nucleophilic ethereal solvent.[22] Decomposition of tris-Ni(0)-olefin complexes in ethereal solvents has been noted in the case of the 16-electron complex ($\mu\eta^2,\eta^2C_7H_{12}$)[Ni($\eta^2,\eta^2C_7H_{12}$)]$_2$. While no evidence was provided, ligand displacement by THF at 20 °C was believed to be the reason for decomposition.[45] Due to that rapid exchange of ligands in solution, complete characterization of the Ni($^{4\text{-CF3}}$stb)$_3$ in solution still poses severe challenges.[22]

Catalytic transformations

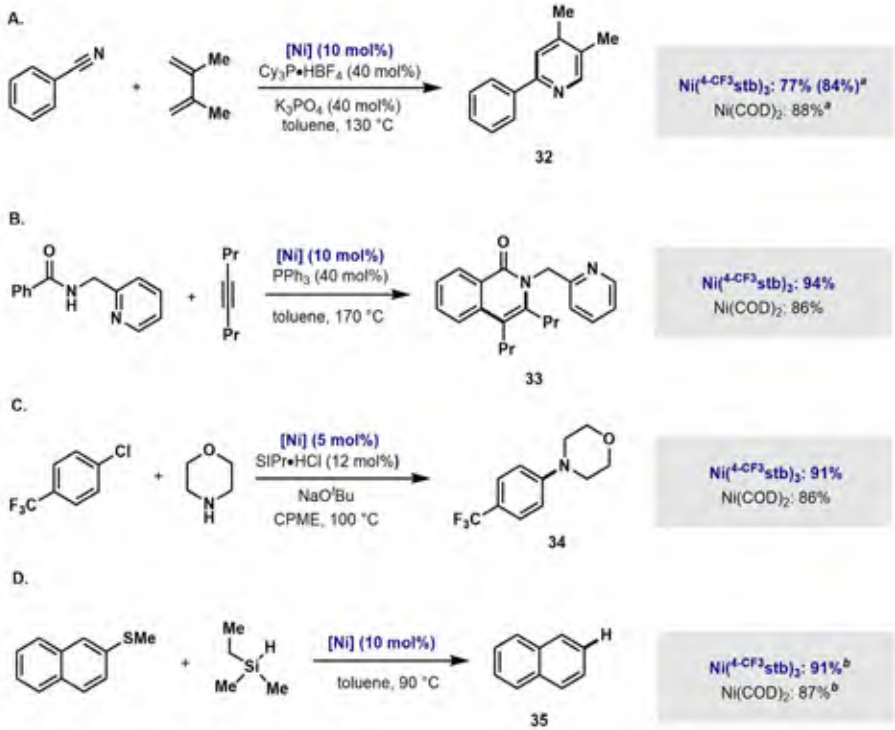
The facile ligand exchange in **19** observed in solution immediately revealed that this behavior should be of high value in catalytic contexts. Moreover, complex **19** has been shown to deliver well-defined Ni(0):L ratios, thus permitting a control over the species at the onset of the reaction. In order to explore the catalytic abilities of **19**, a survey of important catalytic transformations, which utilize Ni as catalyst was performed. The results were benchmarked with the yields reported using either $Ni(COD)_2$ or an alternative Ni(II) precursor.

Hartwig and co-workers reported that $Ni(COD)_2$ was inefficient in the formation of heterobiaryls, making the application of a Ni(II) species essential for a successful coupling.[28] $Ni(^{4\text{-}CF_3}stb)_3$ turned out to be a good pre-catalyst in this catalytic transformation, resulting in the generation of high yields (>99%) of the coupling product (**27**). When $Ni(^{4\text{-}CF_3}stb)_3$ was stored for more than 180 days in a freezer under air, an 82% yield was obtained (Scheme 7A).[22] Good yields were also observed in the aryl coupling with acetals developed by Doyle (Scheme 7B).[22, 46] Furthermore, **19** demonstrated to be also applicable in $C(sp^2)$–$C(sp^2)$ Negishi cross-coupling reactions between an aryl bromide and a vinyl zinc reagent (Scheme 7C).[22, 47] In the context of alkyl-alkyl Negishi coupling, **19** also performed well although higher temperatures where required (Scheme 7D).[22, 48] The requirement of higher temperature might indicate that differences between $Ni(COD)_2$ and $Ni(^{4\text{-}CF_3}stb)_3$ might exist in generating the catalytically active species (*vide infra*). Heck coupling also were amenable and **19** afforded good yields of the C–C product **31** (Scheme 7E).[22, 49]



Scheme 7: *C–C bond forming reactions catalyzed by* ***19****.* ***(A)*** *Heteroaryl Suzuki cross-coupling.* ***(B)*** *C–O arylation of acetals.* ***(C)*** *Aryl-vinyl Negishi cross-coupling.* ***(D)*** *Alkyl-Alkyl Negishi cross-coupling.* ***(E)*** *A Heck-type reaction.* [a]*This reaction was performed with a batch of* ***19*** *that was stored in a freezer at −18 °C under air for >180 d.* [b]*The yield was determined by gas chromatography with a flame ionization detector using an internal standard.* [c]*25 °C.* [d]*Using a catalyst stored under air at 25 °C for 14 d.*

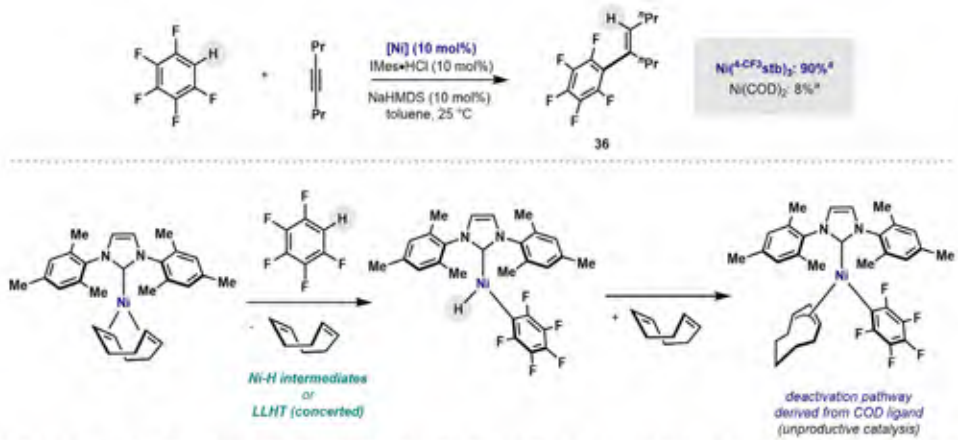
The cycloaddition of benzonitrile with 2,3-dimethylbuta-1,3-diene, using catalytic amounts of PCy_3 and $Ni(COD)_2$, was reported to generate the pyridine derivative **32** in 88% yield.[50] When $Ni(^{4\text{-}CF3}stb)_3$ was employed, a yield of 84% was achieved. Additionally, when displacing the air-sensitive ligand by its protonated air-stable counterpart $PCy_3{\bullet}HBF_4$ together with amounts of K_3PO_4, equimolar to the ligand, an only slightly reduced yield (77%) was obtained, permitting the performance of this catalytic transformation without the need of a glovebox (Scheme 8A).[22]



***Scheme 8**: Additional examples of Ni(0)- catalysis. (**A**) Oxidative cyclization. (**B**) C–H activation. (**C**) Buchwald-Hartwig C–N bond formation with alkylamines. (**D**) C–SMe reduction with silanes. [a]This reaction was performed using PCy_3. [b]The yield was determined by gas chromatography with a flame ionization detector using an internal standard.*

While first examples of C(sp^2)–H bond activation were already reported in 1963,[51] it was not until recently that Ni-catalyzed C–H activation became a routinely explored strategy. Following a recent protocol by Chatani,[52] isoquinolone derivative **33** (Scheme 8B) could be generated in an excellent yield of 94% (86% with $Ni(COD)_2$).[22, 52] Another cross-coupling reaction of paramount importance is the Buchwald-Hartwig amination reaction to forge C(sp^2)–N bonds.[53] Amination of 4-chlorobenzotrifluoride with morpholine proceeded smoothly with the aid of SIPr as the ligand for Ni (91%, Scheme 8C, **34**).[22, 32] Ni(0)-olefin complexes were demonstrated to be a valuable source for the formation of heterogeneous Ni(0) nanoparticles by Martin and co-workers. Reduction of 2-(methylthio)naphthalene with silanes afforded 91% yield of **35** (Scheme 8D).[22, 54]

Finally, we demonstrated that $Ni(^{4\text{-}CF3}stb)_3$ was able to have orthogonal reactivity to that of $Ni(COD)_2$. For example, in the C–H activation of electron-poor arenes, the use of $Ni(COD)_2$ results in the formation of catalytically inactive species as a result of hydrometalation of the COD. Yet, the electron-deficient nature of the double bond in $^{4\text{-}CF3}$stb prevents such hydrometalation in the ligand, and permits the hydrometalation to occur in the triple bond, thus generating **36** in excellent yields (Scheme 9).[22, 26]



Scheme 9: *Ni($^{4\text{-CF}_3}$stb)$_3$ prevents detrimental deactivation pathways associated to the COD in Ni(COD)$_2$. [a]Yield determined by ^{19}F NMR.*

Shortcomings of the Ni($^{4\text{-CF}_3}$stb)$_3$ pre-catalyst

Although Ni($^{4\text{-CF}_3}$stb)$_3$ is applicable to a variety of Ni-catalyzed organic transformations, several limitations still prevailed and required further detailed analysis. For example, Ni($^{4\text{-CF}_3}$stb)$_3$ is unstable at high temperatures when heated in the solid state. Moreover, the complex decomposes within a week when exposed to air at room temperature. More importantly, Ni($^{4\text{-CF}_3}$stb)$_3$ is also unstable in solution without supporting ligands, which prevents the preparation of stock solutions or its use in certain homogenous "ligand-less" reactions. Finally, the electron-deficient nature of the $^{4\text{-CF}_3}$stb ligand affects elementary steps in certain catalytic domains, thus requiring harsher conditions (Figure 3).[22]

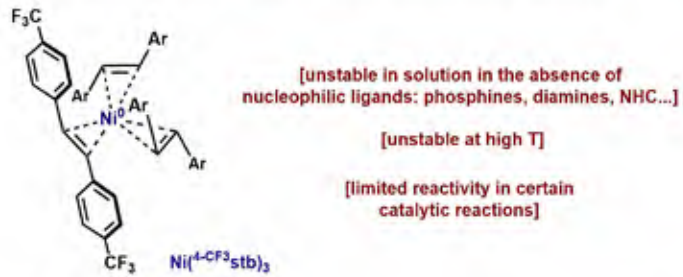
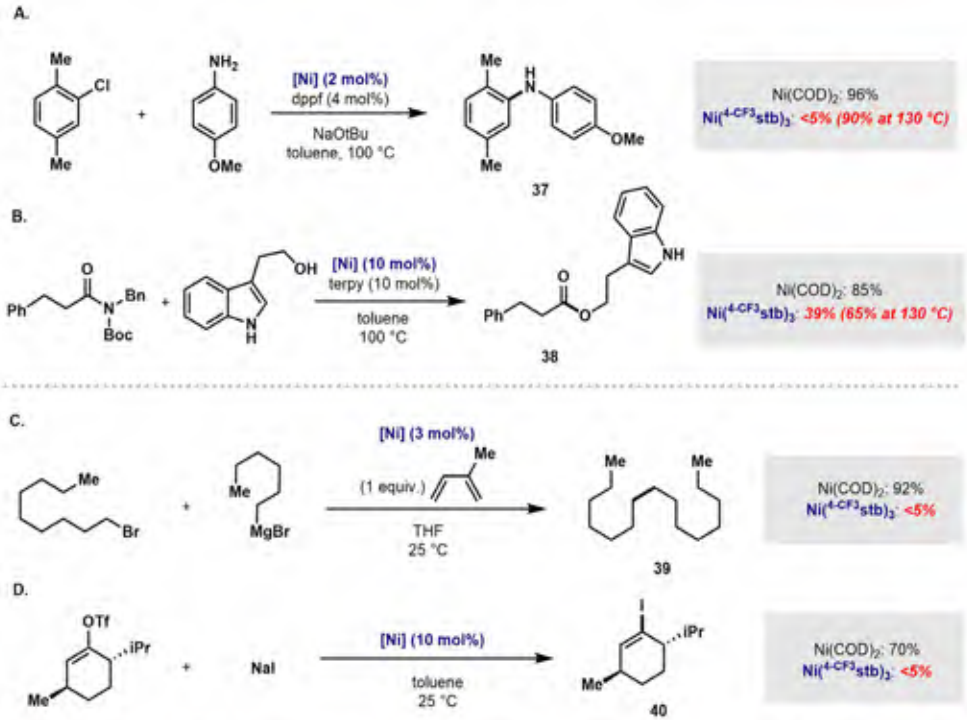


Figure 3: *Drawbacks of the air-stable Ni($^{4\text{-CF}_3}$stb)$_3$.*

These limitations have consequences when attempting certain catalytic reactions (Scheme 10). For example, the Buchwald-Hartwig amination using anilines required slightly elevated reaction temperatures (130 °C) to generate **37** in 90% yield (Scheme 10A).[55] When performing the reaction at 100 °C, as reported for Ni(COD)$_2$, traces of product were observed.[22] A similar behavior was observed in the Ni-catalyzed ester formation from amides reported by Garg. While ester **38** was generated in a yield of 85% when using Ni(COD)$_2$ at 100 °C,[56] only 39% was obtained when using Ni($^{4\text{-CF}_3}$stb)$_3$. Heating up the reaction to 130 °C led to an increase in yield up to 65% (Scheme 10B).[22] We believe that in these cases, the high energetic cost to dissociate the stilbene ligand from L–Ni(0)–stilbene complexes might affect the energetic profile of the reaction (*vide infra*).[22]

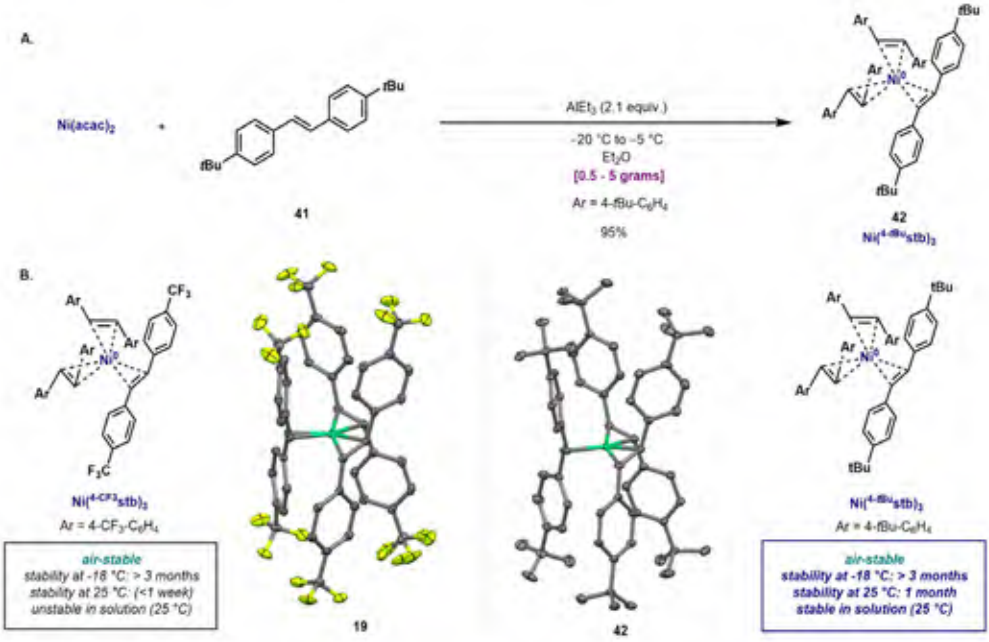


Scheme 10: *Limitations in the catalytic reactivity of Ni($^{4\text{-CF}_3}$stb)$_3$. (**A**) Buchwald-Hartwig C–N bond formation with arylamines. (**B**) Ester formation through C–N bond activation of amides. (**C**) Alkyl-alkyl Kumada cross-coupling. (**D**) Conversion of vinyl triflates into vinyl iodides.*

Examples of the instability of Ni($^{4\text{-CF}_3}$stb)$_3$ in solution can be found when attempting the Kambe coupling[57] or the Reisman triflate-iodide exchange.[58] In both cases Ni($^{4\text{-CF}_3}$stb)$_3$ does not survive the time required to generate the active species, thus decomposing without catalyzing the reaction (Scheme 10C and D).[22]

Ni($^{4\text{-tBu}}$stb)$_3$ – 2nd generation of air-stable pre-catalysts

In order to tackle the problematics associated with Ni($^{4\text{-CF}_3}$stb)$_3$, various Ni(0) stilbene complexes bearing different substituents in the stilbene unit were synthesized, isolated and characterized.[59] Eventually, solid-state analysis led us to hypothesize that in addition to its electronic influence, the CF_3-moiety also exerted a severe steric constraint at the edges of the complexes. We then envisaged that in order to discriminate between electronics and steric effects in the stability toward oxidation, the CF_3 group could be replaced by the isostere ^{t}Bu group. Indeed, a complex bearing three *p*-^{t}Bu-stilbene ligands (**41**) was successfully synthesized following the optimized protocol for **19** (Scheme 11A). This orange complex (**42**, Ni($^{4\text{-tBu}}$stb)$_3$) was found to be remarkably air stable when compared to all the previously synthesized complexes, including **19**. A direct comparison of the physical properties between **19** and **42** is highlighted in Scheme 11B. It is clear that **42** exhibits both an increased stability in solid state as well as in solution.[59] While **19** suffers from decomposition in solution at ambient temperature when no external ligand is added, **42** does not suffer from these drawbacks, and the Ni species remain stable in solution in various solvents. Although both complexes are stable for at least 3 months in the freezer (–18 °C), **42** did not show signs of decomposition for one month at room temperature.[59] Once again, the composition of this complex as well as its structure was determined by elemental analysis, X-ray crystallography, XPS, titration and degradation studies. Yet, complete structural analysis by NMR was prevented due to the exchange of the ligands in solution.[59]



Scheme 11: *(**A**) Preparation of Ni(4-tBustb)$_3$. (**B**) Comparison between **19** and **42** and ORTEP structures of these complexes compared to each other. Colors: Green: Ni, Black: C, Yellow: F. Hydrogen atoms are omitted for clarity.*

Catalytic transformations

The different stabilities in solution between **19** and **42** suggested that different ligand exchange rates occur, which could dramatically affect the catalytic properties of each complex. An example of such differences was noted in the Buchwald-Hartwig amination reaction with anilines (*vide supra*).[55] When the reaction profile was monitored by NMR, severe differences were encountered. While complex **19** was inefficient at the reported temperature (100 °C), the newly prepared complex **42** catalyzed the reaction smoothly (Figure 4).[59]

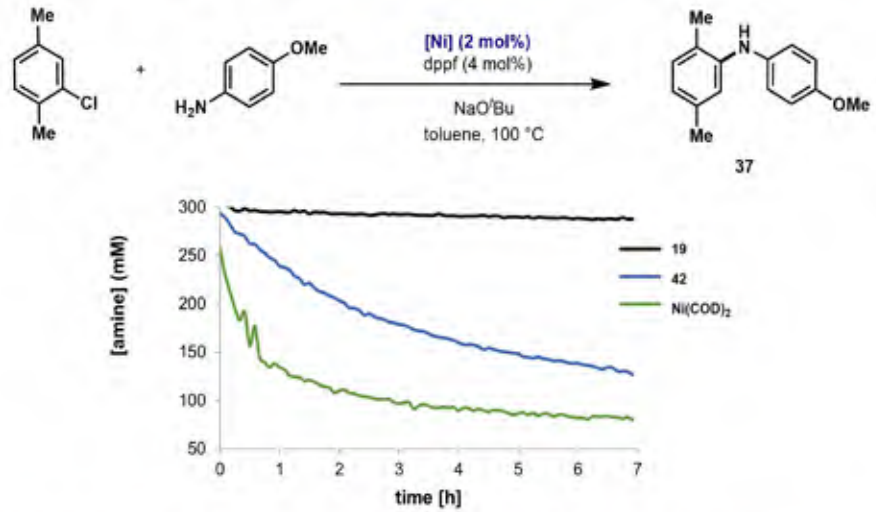
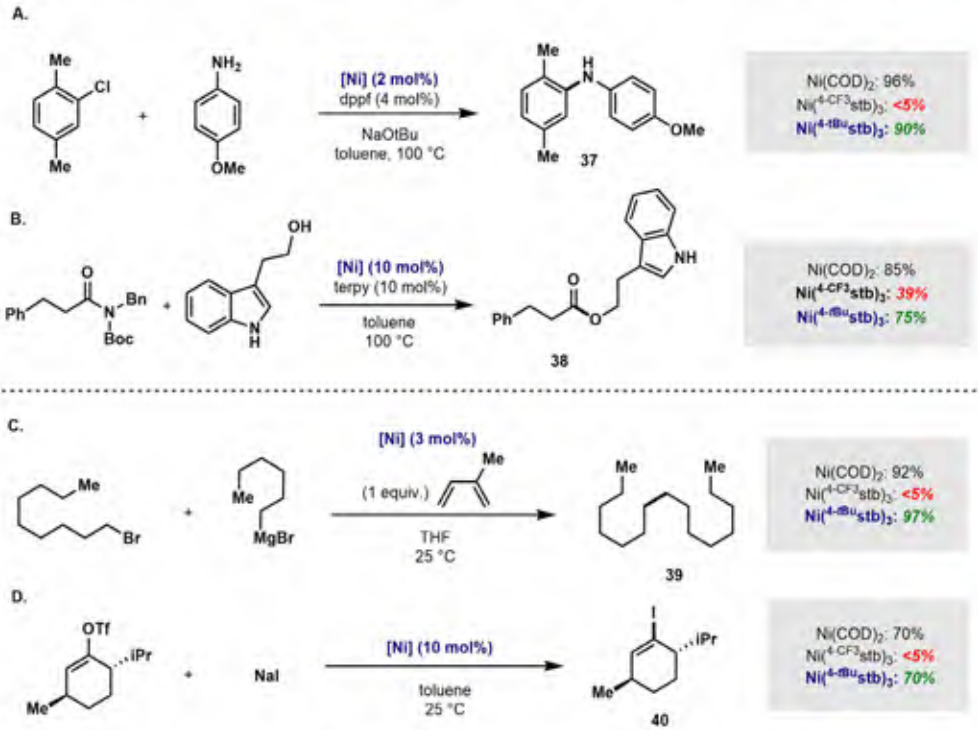


Figure 4: *Kinetic profiles of the consumption of the aryl chloride in the Buchwald-Hartwig amination.*

The differences in reactivity observed, led us to hypothesize that Ni($^{4\text{-tBu}}$stb)$_3$ could be amenable in transformations where Ni($^{4\text{-CF3}}$stb)$_3$ failed to react. Therefore, reactions in Scheme 10 were repeated using Ni($^{4\text{-tBu}}$stb)$_3$ instead (Scheme 12). As shown, the Buchwald-Hartwig amination (Scheme 12A),[55,59] the activation of amides (Scheme 12B).[56,59] Kambe's alkyl-alkyl cross-coupling using isoprene as ligand (Scheme 12C),[57] as well as the catalytic conversion of vinyl triflates into vinyl iodides (Scheme 12D),[58] recovered the reactivity when using Ni($^{4\text{-tBu}}$stb)$_3$, affording similar yields as seen with Ni(COD)$_2$.[59]



Scheme 12: *Catalytic transformations performed. (**A**) Buchwald-Hartwig C–N bond formation with arylamines. (**B**) Ester formation through C–N bond activation of amides. (**C**) Alkyl-alkyl Kumada cross-coupling. (**D**) Conversion of vinyl triflates into vinyl iodides.*

The differences in reactivity between different stilbene ligands are certainly of great interest, as tuning the electronics on the olefin should now be considered as an additional parameter when optimizing Ni-catalyzed transformations. Investigations on the physical properties, catalytic activity, stereoelectronic effects and structural differences rendered by the simple change of substituents in the stilbene unit in Ni(0) complexes are currently ongoing in our laboratory.

Summary

In summary, complexes Ni($^{4\text{-CF3}}$stb)$_3$ (Strem 28-0060) and Ni($^{4\text{-tBu}}$stb)$_3$ (Strem 28-0070) represent more air-stable alternatives to the current Ni(0) sources, which allows practical incorporation of Ni(0) into routine experimentation. These two complexes permit the practitioner to perform a plethora of various catalytic transformations commonly applied in organic synthesis without the need of using gloveboxes or complex Schlenk techniques. It has been shown that Ni($^{4\text{-CF3}}$stb)$_3$ can be as catalytically competent as Ni(COD)$_2$, and in some instances, surpasses its catalytic activity. The instability of Ni($^{4\text{-CF3}}$stb)$_3$ in solution without the addition of external ligands together with the decomposition after prolonged exposure to air, led to the design and synthesis of Ni($^{4\text{-tBu}}$stb)$_3$. This last complex represents a robust source of Ni(0), with broader scope of reactivity which approaches the levels of Ni(COD)$_2$.

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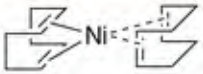
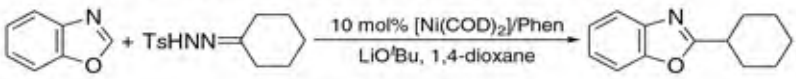
NICKEL (Compounds)

28-0010 **Bis(1,5-cyclooctadiene)nickel (0), 98+%** *(1295-35-8)* 2g
HAZ $(C_8H_{12})_2Ni$; FW: 275.08; yellow xtl.; m.p. 60° dec. (under N_2) 10g
air sensitive, (store cold)

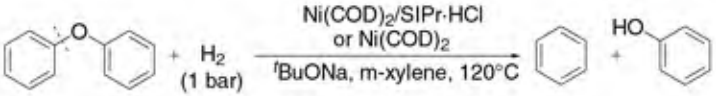


Technical Notes:

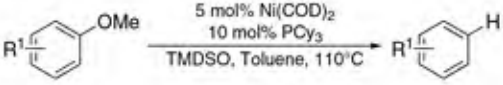
1. Pre-catalyst for the coupling of benzoxazole with N-tosylhydrazone.
2. Catalyst precursor for heterogeneously nickel-catalysed hydrogenolysis of aryl ethers without arene hydrogenation.
3. Pre-catalyst for reductive cleavage of C–OMe bonds with silanes as reducing agents.
4. Pre-catalyst for the cross-coupling reactions of benzylic pivalates with arylboroxines.
5. Pre-catalyst for the cross-coupling of benzylic carbamates with arylboronic esters.
6. Pre-catalyst for the direct arylation of $C(sp^3)$–H Bonds in aliphatic amides via bidentate-chelation.
7. Pre-catalyst for the cross-coupling reactions of potassium alkoxyalkyl- and benzyltrifluoroborates with an array of aryl bromides and co-catalyzed by iridium photoredox catalyst under visible light at ambient temperature.
8. Pre-catalyst for highly regioselective indoline synthesis, co-catalyzed by Ruthenium photoredox catalyst.
9. Catalyst for conversion of amides to esters via the activation of amide C–N bonds.
10. Catalyst for borylation of aryl fluorides via C–F cleavage.
11. Catalyst for Suzuki-Miyaura coupling of amides.
12. Catalyst for the cross-coupling reaction of the aryl methyl ether alkylation.



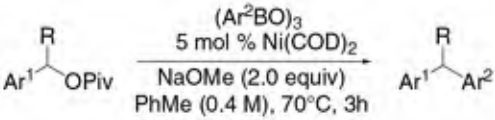
Tech. Note (1)
Ref. (1)



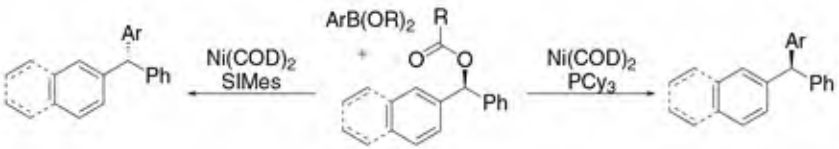
Tech. Note (2)
Ref. (2)



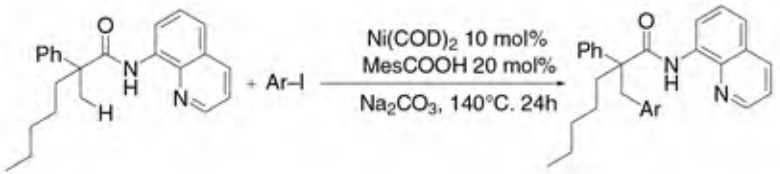
Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



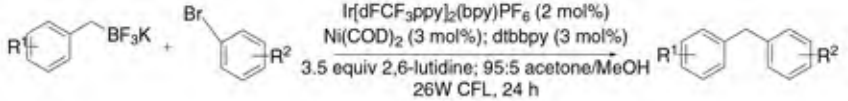
Tech. Note (5)
Ref. (5)



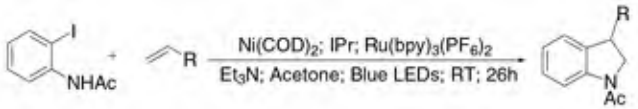
Tech. Note (6)
Ref. (6)

NICKEL (Compounds)

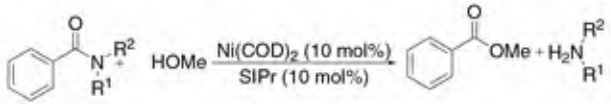
28-0010 **Bis(1,5-cyclooctadiene)nickel (0), 98+%** *(1295-35-8)*
(continued)



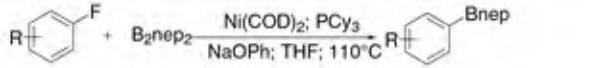
Tech. Note (7)
Ref. (7)



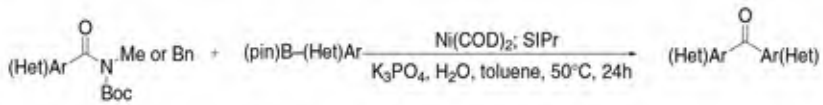
Tech. Note (8)
Ref. (8)



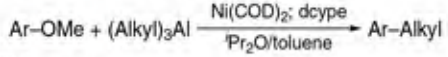
Tech. Note (9)
Ref. (9)



Tech. Note (10)
Ref. (10)



Tech. Note (11)
Ref. (11)

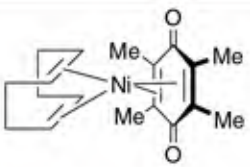


Tech. Note (12)
Ref. (12)

References:

1. *Angew. Chem. Int. Ed.*, **2012**, *51*,775.
2. *J. Am. Chem. Soc.*, **2012**, *134*, 20226.
3. *J. Am. Chem. Soc.*, **2013**, *135*, 1997.
4. *J. Am. Chem. Soc.*, **2013**, *135*, 3307.
5. *J. Am. Chem. Soc.*, **2013**, *135*, 3303.
6. *J. Am. Chem. Soc.*, **2014**, *136*, 898.
7. *Science*, **2014**, *345*, 433.
8. *J. Am. Chem. Soc.*, **2015**, *137*, 9531.
9. *Nature*, **2015**, *524*, 79.
10. *J. Am. Chem. Soc.*, **2015**, *137*, 12470.
11. *Nature Chemistry*, **2016**, *8*, 75.
12. *Angew. Chem. Int. Ed.*, **2016**, *55*, 6093.

28-0040 **(1,5-Cyclooctadiene)(duroquinone) nickel(0), min. 98%** *(40759-64-6)*
NEW
$C_{18}H_{24}NiO_2$; FW: 331.08; orange to red solid; m.p. 227(dec)



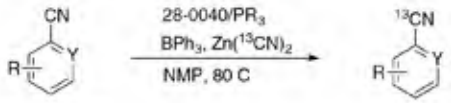
250mg
1g

Technical Notes:

1. Catalyst for C-CN bond activation in late-stage carbon isotope exchange of aryl nitriles.[1]
2. Air stable Nickel(0)-olefin precatalyst for a variety of synthetic methods including Suzuki-Miyaura cross coupling reactions and amination of aryl chlorides.[2]

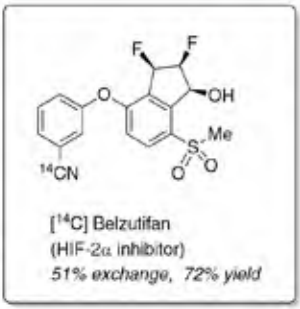
NICKEL (Compounds)

28-0040 **(1,5-Cyclooctadiene)(duroquinone) nickel(0), min. 98%** *(40759-64-6)*
(continued)



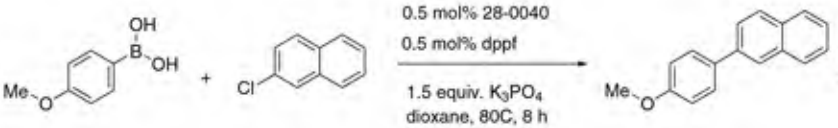
(Y = CH or N)

Late-stage incorporation of ^{13}CN and ^{14}CN labels
First carbon isotope exchange method for nitriles
Over 30 examples, with 10 complex pharmaceuticals
Aryl, heteroaryl, and alkenyl nitriles

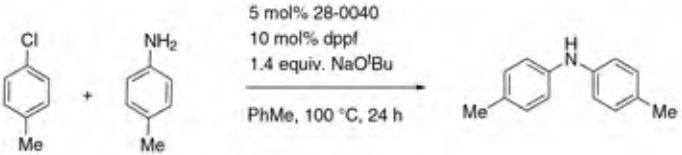


[^{14}C] Belzutifan
(HIF-2α inhibitor)
51% exchange, 72% yield

Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (2)
Ref. (2)

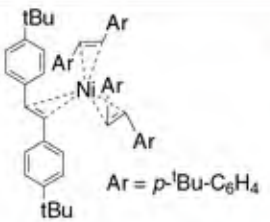
References:

1. *J. Am. Chem. Soc.* **2021**, *143*, 4817.
2. *Angew. Chem. Int. Ed.* **2020**, *59*, 7409.

28-0070 **Tris(trans-1,2-bis(4-tert-butylphenyl)ethene)nickel(0), min. 97%** *(2468315-70-8)*

NEW

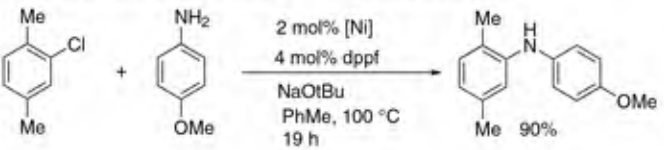
$C_{86}H_{84}Ni$; FW: 936.07; red-orange pwdr.
(store cold)
Note: Prolonged storage under inert atmosphere recommended.
Patents: EP19189236.3, DE 102019214138.2. Product sold under, use subject to, terms and conditions of Limited Use License found at www.strem.com/sgk1



1g
5g

Technical Note:

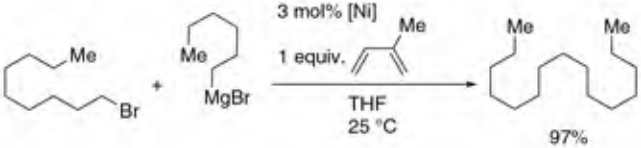
1. Temperature and air-stable Ni(0) source. Applications include a fast kinetic profile in Buchwald-Hartwig amination reactions. Other uses include various catalytic transformations with and without external ligands, and many other industrially relevant transformations.



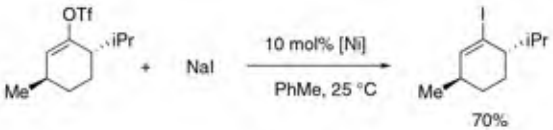
Tech. Note (1)
Ref. (1)

NICKEL (Compounds)

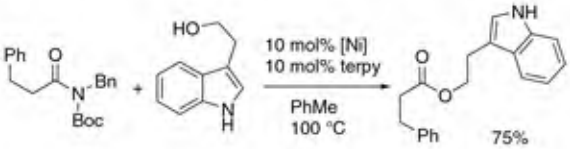
28-0070 **Tris(trans-1,2-bis(4-tert-butylphenyl)ethene)nickel(0), min. 97%** *(2468315-70-8)*
(continued)



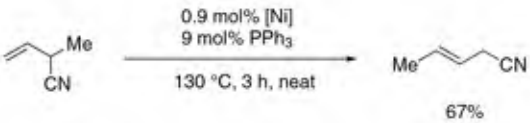
Tech. Note (1)
Ref. (1)



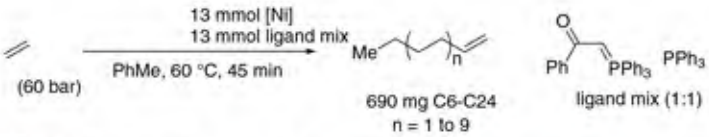
Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)



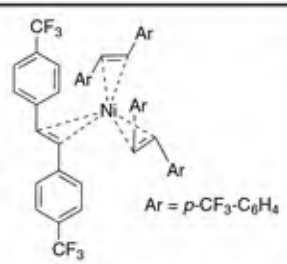
Tech. Note (1)
Ref. (1)

References:

1. *Organometallics*, **2020**, *39*, 3295-3300.

28-0060 **NEW**

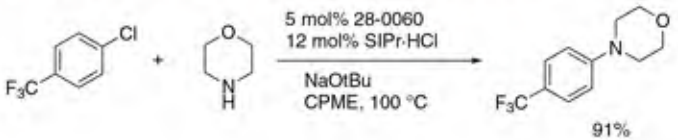
Tris(trans-1,2-bis(4-(trifluoromethyl)phenyl)ethene) nickel(0), min. 97% *(2413906-36-0)*
$C_{48}H_{30}F_{18}Ni$; FW: 1007.41; red solid
(store cold)
Note: Prolonged storage under inert atmosphere recommended.
Patents: EP19189236.3, DE 102019214138.2. Product sold under, use subject to, terms and conditions of Limited Use License found at www.strem.com/sgk1



1g
5g

Technical Notes:

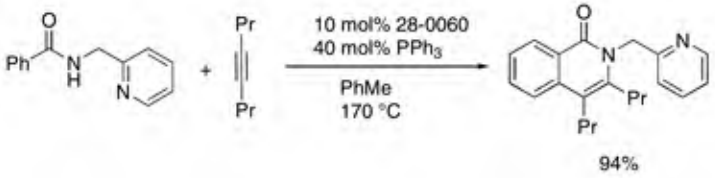
1. Air-stable Ni(0) source. Catalyst can be weighed out in air. Decomposition of the catalyst occurs at 25 °C eventually under air after ca. 1 week.
2. Applications include various catalytic transformations.
3. Electron-deficient stilbene prevents ligand hydrometallation.



Tech. Note (1)
Ref. (1)

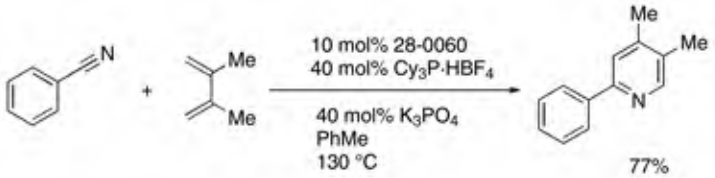
NICKEL (Compounds)

28-0060 **Tris(trans-1,2-bis(4-(trifluoromethyl)phenyl)ethene)nickel(0), min. 97%** *(2413906-36-0)*
(continued)



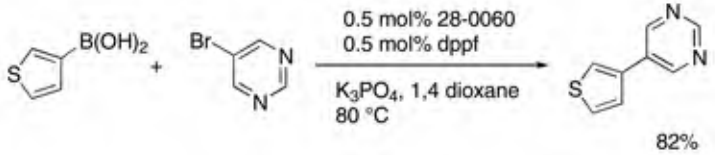
94%

Tech. Note (1)
Ref. (1)



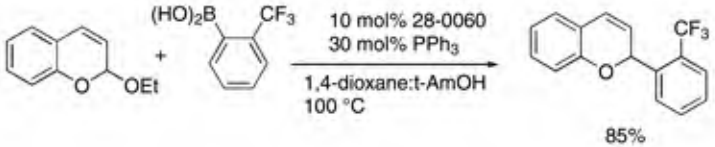
77%

Tech. Note (1)
Ref. (1)



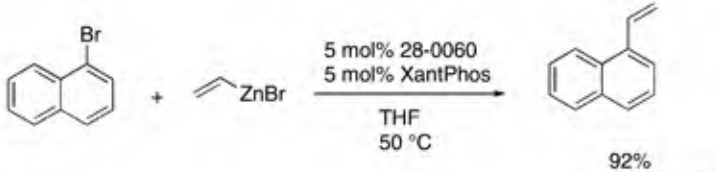
82%

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



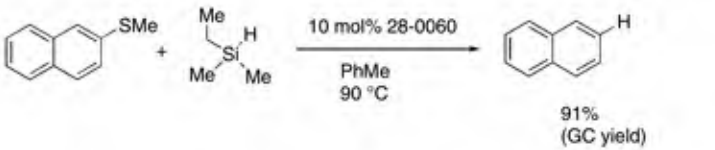
85%

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



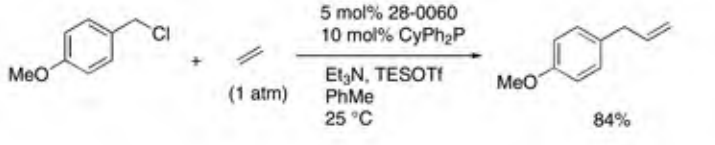
92%
(GC Yield)

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



91%
(GC yield)

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

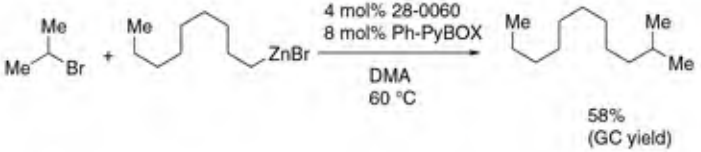


84%

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

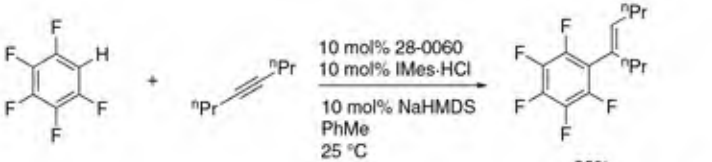
NICKEL (Compounds)

28-0060 **Tris(trans-1,2-bis(4-(trifluoromethyl)phenyl)ethene)nickel(0), min. 97%** *(2413906-36-0)*
(continued)



58%
(GC yield)

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



90%
(19F NMR yield)

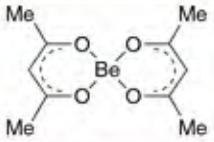
Tech. Note (1,2,3)
Ref. (1)

References:
1. *Nat. Catal.* **2020**, *3*, 6-13.

BERYLLIUM (Compounds)

04-4000 NEW HAZ

Beryllium(II) acetylacetonate min. 97% *(10210-64-7)*
$Be(CH_3COCHCOCH_3)_2$; FW: 207.22; white pwdr.; m.p. 108; d. 1.116
moisture sensitive
Note: sublimes at 90 °C at 0.2 Torr

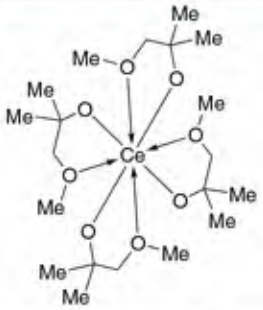


2g
10g

CERIUM (Compounds)

58-5500 NEW

Tetrakis[1-(methoxy)-2-methyl-2-propanolato] cerium, [Ce(mmp)4], 98% *(1262520-82-0)*
$C_{20}H_{44}CeO_8$; FW: 552.68; light yellow to orange pwdr.
air sensitive, moisture sensitive



500mg
2g

Technical Note:

1. CVD and ALD alkoxide precursor for preparation of cerium thin films:

Film	Reactants/Conditions	Substrate/Temperature	Ref
CeO_2	[Ce(mmp)4] in toluene; 1 mbar; Oxidants: O_2 (MOCVD) or H_2O (ALD)	Si(100); 250-600°C (MOCVD); 150-350°C (ALD)	[1-3]
$CeAlO_3$	[Ce(mmp)4] in toluene; 1 mbar; Oxidant: O_2 (MOCVD); $Et_2Al(OEt)$	Si(100), Si(100)//TiN; 400-450°C	[4]
Pt@CeO_2	[Ce(mmp)4] in cyclohexane; 10 hPa Oxidant: O_2 (MOCVD); [$MeCpPtMe_3$]	Si(100); 400°C	[5]
CeO_2	[Ce(mmp)4] in cyclohexane;10 mbar Oxidant: O_2 (MOCVD)	Si(100), Carbon foil; 400 °C	[6]
CeO_2	[Ce(mmp)4] in toluene; 1 mbar Oxidant: O_2 (ALD)	Si(100), Si(100)//TiN; 250°C	[7]

Thermal behavior

- Under atmospheric pressure [Ce(mmp)4] shows a continual, gradual loss of mass over the temperature range 25-180°C,
  followed by rapid loss of mass at 180-250°C. Mass loss is complete at 300°C with remaining residue of 16.5% (probably CeO_2).
- [Ce(mmp)4] sublimes intact at 120°C without deposition of residues at low pressure (0.8 Torr).
- Thermal decomposition at ~275 °C [1].
- TGA data is available in [1] and [2].

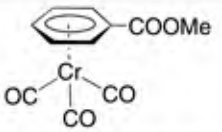
References:

1. *Chem. Vap. Deposition* **2009**, *15*, 259.
2. *Inorg. Chem.* **2011**, *50*, 11644.
3. *Nanoscale Res. Lett.* **2013**, *8*, 456.
4. *Thin Solid Films* **2013**, *536*, 68.
5. *Thin Solid Films* **2015**, *589*, 246.
6. *Surf. Coat. Tech.* **2015**, *280*, 148.
7. *Beilstein J. Nanotechnol.* **2018**, *9*, 890.

CHROMIUM (Compounds)

24-0600 — NEW — HAZ

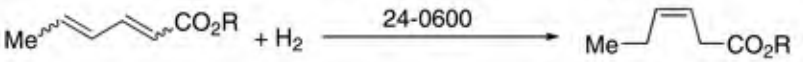
Methylbenzoate chromium tricarbonyl, min. 98% *(12125-87-0)*
$C_{11}H_8CrO_5$; FW: 272.18; orange solid;
m.p. 95-96°C
air sensitive, moisture sensitive



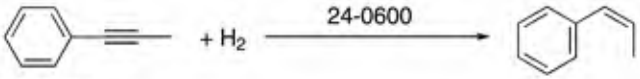
500mg
2g

Technical Note:

1. Chromium carbonyl based catalyst for the hydrogenation of conjugated dienes[2,3] and alkynes.[1]



Tech. Note (1)
Ref. (3)



Tech. Note (1)
Ref. (1)

References:

1. *Synthesis* **1993**, *7*, 643.
2. *Russ. Chem. Bull.* **2002**, *51*, 1341.
3. *Russ. Chem. Bull.* **2018**, *67*, 923.

ELECTROPOLISHED STAINLESS STEEL BUBBLERS (Vertical)

95-1050 — NEW

Stainless steel bubbler, 600ml, vertical, electropolished with fill-port, pneumatic actuator valves, DOT 4B

1cyl

GADOLINIUM (Compounds)

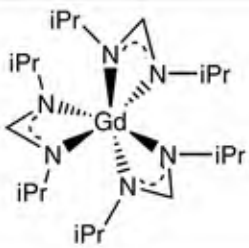
64-4250 — NEW

Gadolinium(III) bromide, anhydrous (99.99%-Gd) (REO) PURATREM *(13818-75-2)*
$GdBr_3$; FW: 396.96; white xtl.; m.p. 770
air sensitive, moisture sensitive, hygroscopic

5g
25g

64-3575 — NEW

Tris(N,N'-di-i-propylformamidinato)gadolinium(III), (99.999+%-Gd) PURATREM Gd-FMD
$C_{21}H_{45}GdN_6$; FW: 538.87; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Product sold under, use subject to, terms and conditions of label license at www.strem.com/harvard2.



1g
5g

KITS (Compounds)

96-0280 — NEW

Chromalite® SpectraChrom Kit
Sold in collaboration with Purolite for research purposes only.

Contains 25ml of the following:

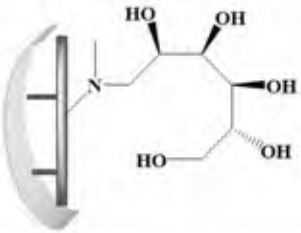
Chromalite MIDA/M/Ni
Chromalite MIDA/M/Co
Chromalite MIDA/M/Zn
Chromalite MIDA/M/Cu
Chromalite MIDA/M/Fe
Chromalite MIDA/M

1 kit

METALS SCAVENGING AGENTS (Compounds)

08-4225 NEW

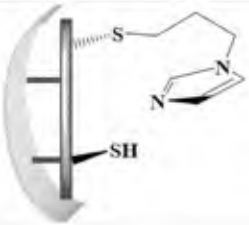
Glucamine Alkyl Silica, borate scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.



10g
50g

16-0800 NEW

Imidazole Sulfide Mercapto Alkyl Silica, metals and organic impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.



10g
50g

16-0805 NEW

Octadecyl Sulfide Propyl Silica, non-polar impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.

10g
50g

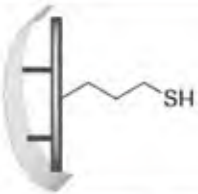
08-4230 NEW

Poly Carboxylic Acid Alkyl Silica, metals and organic impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.

10g
50g

16-0815 NEW

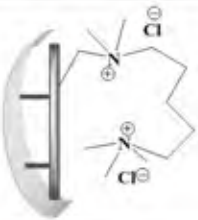
Poly Mercaptoalkyl Silica, metals and organic impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 20-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.



10g
50g

07-9255 NEW

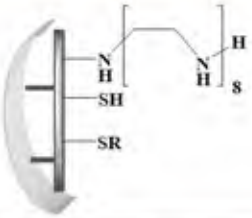
Poly Quaternary Ammonium Alkyl Silica, metals and organic impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.



10g
50g

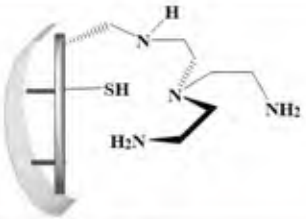
METALS SCAVENGING AGENTS (Compounds)

16-0810 NEW
Polyamine Sulfide Alkyl Silica, metals and organic impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.



10g
50g

16-0820 NEW
Tetraamine Sulfide Alkyl Silica, metals and organic impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.



10g
50g

16-0825 NEW
Thiourea Sulfide Mercapto Silica, metals and organic impurity scavenger
yellow-white pwdr.
moisture sensitive
Note: Particle size 37-200 µm
Sold in collaboration with Si-Novation for research purposes only. Patent: PCT/CN2016/092663.

10g
50g

MOFS AND LIGANDS FOR MOF SYNTHESIS (Compounds)

29-3150 NEW
Copper benzene-1,3,5-tricarboxylate MOF (HKUST-1(Cu))/PVDF membrane (35/65 wt.%) *(51937-85-0)*
blue membrane; SA: BET 500 m^2/g
moisture sensitive

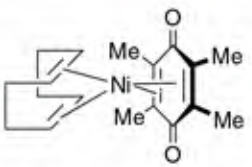
1x1cm

40-1125 NEW
Zirconium 1,4-dicarboxybenzene MOF (UiO-66)/PVDF membrane (60/40 wt.%) *(1072413-89-8)*
white membrane; SA: BET 650-700 m^2/g
moisture sensitive

1x1cm

NICKEL (Compounds)

28-0040 NEW
(1,5-Cyclooctadiene)(duroquinone) nickel(0), min. 98% *(40759-64-6)*
$C_{18}H_{24}NiO_2$; FW: 331.08; orange to red solid; m.p. 227(dec)



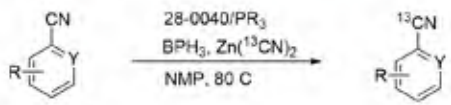
250mg
1g

Technical Notes:

1. Catalyst for C-CN bond activation in late-stage carbon isotope exchange of aryl nitriles.[1]
2. Air stable Nickel(0)-olefin precatalyst for a variety of synthetic methods including Suzuki-Miyaura cross coupling reactions and amination of aryl chlorides.[2]

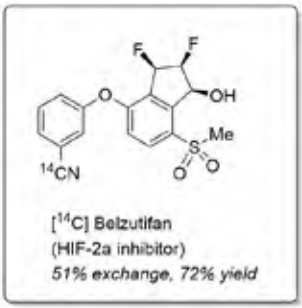
NICKEL (Compounds)

28-0040 **(1,5-Cyclooctadiene)(duroquinone) nickel(0), min. 98%** *(40759-64-6)*
(continued)



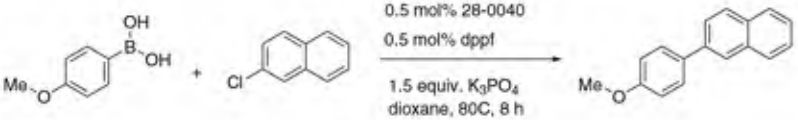
(Y = CH or N)

Late-stage incorporation of ^{13}CN and ^{14}CN labels
First carbon isotope exchange method for nitriles
Over 30 examples, with 10 complex pharmaceuticals
Aryl, heteroaryl, and alkenyl nitriles

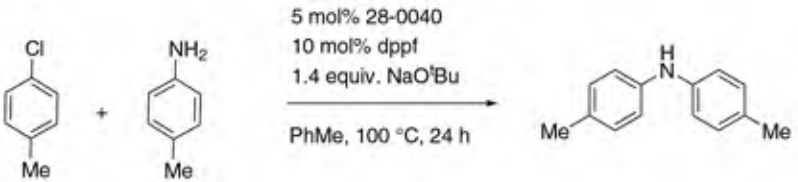


[^{14}C] Belzutifan
(HIF-2a inhibitor)
51% exchange, 72% yield

Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



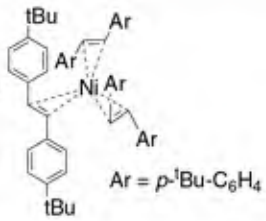
Tech. Note (2)
Ref. (2)

References:

1. *J. Am. Chem. Soc.* **2021**, *143*, *12*, 4817-4823.
2. *Angew. Chem. Int. Ed.* **2020**, *59*, 7409.

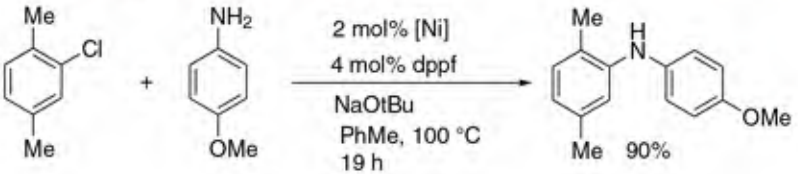
28-0070 NEW
Tris(trans-1,2-bis(4-tert-butylphenyl)ethene) nickel(0), min. 97% *(2468315-70-8)*
$C_{66}H_{84}Ni$; FW: 936.07; red-orange pwdr.
(store cold)
Note: Prolonged storage under inert atmosphere recommended.
Patents: EP19189236.3, DE 102019214138.2.
Product sold under, use subject to, terms and conditions of Limited Use License found at www.strem.com/sgk1

1g
5g



Technical Note:

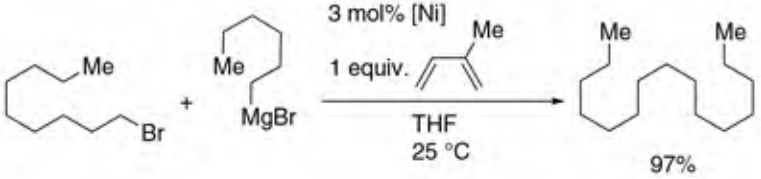
1. Temperature and air-stable Ni(0) source. Applications include a fast kinetic profile in Buchwald-Hartwig amination reactions.
   Other uses include various catalytic transformations with and without external ligands, and many other industrially relevant transformations.



Tech. Note (1)
Ref. (1)

NICKEL (Compounds)

28-0070 **Tris(trans-1,2-bis(4-tert-butylphenyl)ethene)nickel(0), min. 97%** *(2468315-70-8)*
(continued)



Tech. Note (1)
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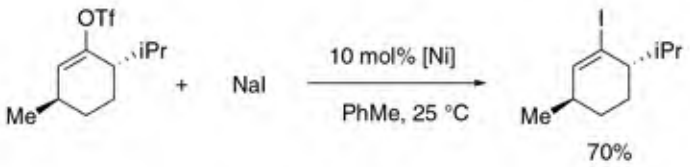
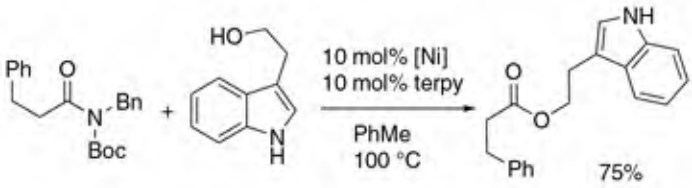
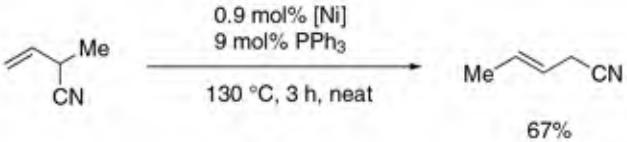


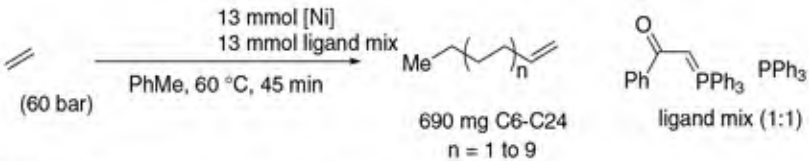
Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)



Tech. Note (1)
Ref. (1)

References:

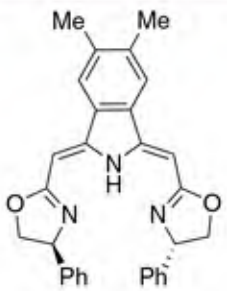
1. *Organometallics*, **2020**, *39*, 3295-3300.

NITROGEN (Compounds)

07-1070

NEW

(1Z,3Z)-1,3-Bis[[(4S)-4,5-dihydro-4-phenyl-2-oxazolyl]methylene]-2,3-dihydro-5,6-dimethyl-1H-isoindole, 95% *(1358991-79-3)*
$C_{32}H_{27}N_3O_2$; FW: 461.6; light yellow to yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



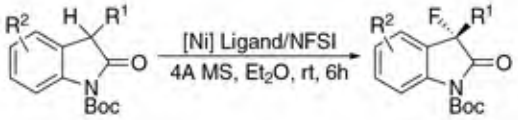
25mg
100mg

NITROGEN (Compounds)

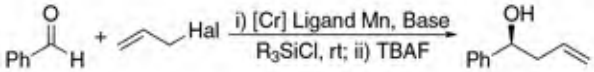
07-1070 ***(continued)*** **(1Z,3Z)-1,3-Bis[[(4S)-4,5-dihydro-4-phenyl-2-oxazolyl]methylene]-2,3-dihydro-5,6-dimethyl-1H-isoindole, 95%** *(1358991-79-3)*

Technical Notes:

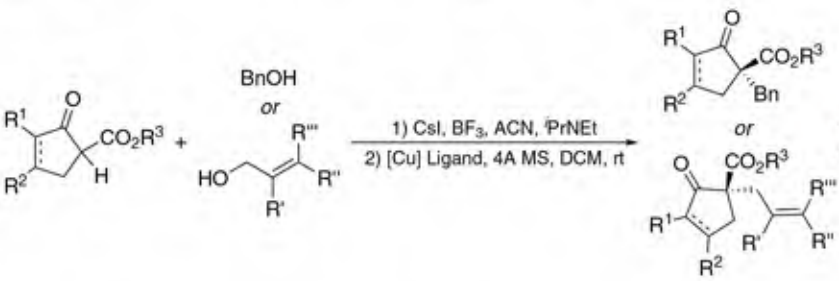
1. Ligand for the Ni-catalzyed enantioselective fluorination of oxindoles.
2. Ligand used in Nozaki-Hiyama-Kishi reaction.
3. Ligand for the highly enantioselective Cu-catalyzed alkylation of β-ketoesters with benzyl and allylic alcohols.
4. Ligand for the highly enantioselective Cu-catalyzed electrophilic trifluoromethylation and trifluoromethylthiolations of β-ketoesters.



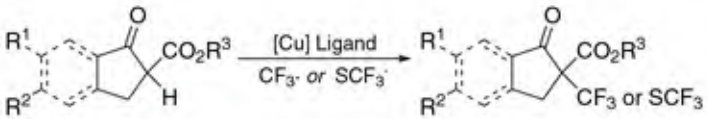
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (1)



Tech. Note (3)
Ref. (2)



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

References:

1. *Chem. Eur. J.* **2011**, *17*, 14922.
2. *J. Am. Chem. Soc.* **2012**, *134*, 2946.
3. *J. Am. Chem. Soc.* **2012**, *134*, 10769.
4. *Chem. Eur. J.* **2014**, *20*, 93.

07-1065

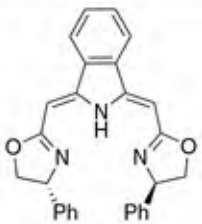
NEW

(1Z,3Z)-1,3-Bis[[(4R)-4,5-dihydro-4-phenyl-2-oxazolyl]methylene]-2,3-dihydro-1H-isoindole, 95% *(1429056-54-1)*

$C_{28}H_{23}N_3O_2$; FW: 433.5; light yellow to yellow pwdr.

moisture sensitive, (store cold)

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



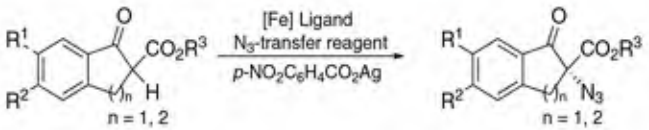
25mg
100mg

Technical Notes:

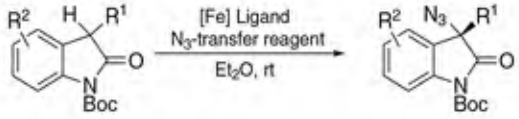
1. Ligand for the enantioselective Fe-catalyzed azidation of β-ketoesters and oxindoles.
2. Ligand for the enantioselective Fe-catalyzed hydrosilylation of ketones.
3. Ligand for the enantioselective Zn-catalyzed allylation of oxindole derivatives with allyl bromide.
4. Ligand for the Zn-catalyzed asymmetric electrophilic cyanation of 3-substituted oxindoles.
5. Ligand for the α-selective Co-catalyzed hydroborations of alkynes.

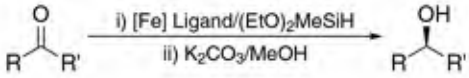
NITROGEN (Compounds)

07-1065 ***(continued)*** **(1Z,3Z)-1,3-Bis[[(4R)-4,5-dihydro-4-phenyl-2-oxazolyl]methylene]-2,3-dihydro-1H-isoindole, 95%** *(1429056-54-1)*

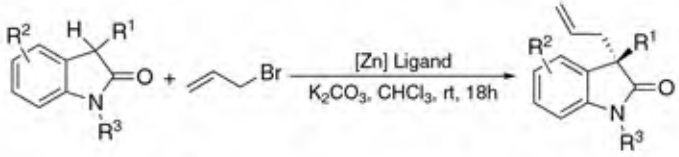


Tech. Note (1)
Ref. (1)

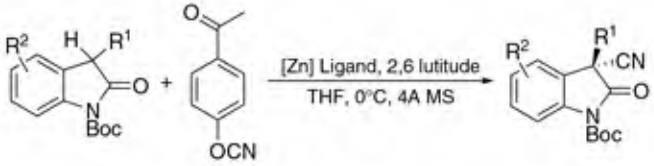




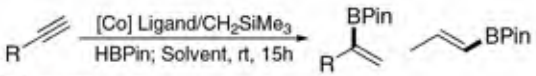
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

References:

1. *J. Am. Chem. Soc.* **2013**, *135*, 5356.
2. *J. Am. Chem. Soc.* **2015**, *137*, 2456.
3. *Angew. Chem. Int. Ed.* **2016**, *55*, 7852.
4. *Org. Lett.* **2017**, *19*, 4018.
5. *Angew. Chem. Int. Ed.* **2020**, *59*, 23010.

07-1068

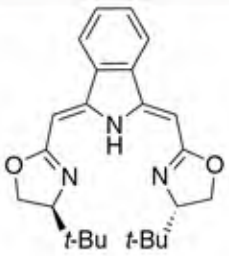
NEW

(1Z,3Z)-1,3-Bis[[(4S)-4,5-dihydro-4-(tert-butyl)-2-oxazolyl]methylene]-2,3-dihydro-1H-isoindole, 98% *(1361563-41-8)*

$C_{24}H_{31}N_3O_2$; FW: 393.5; light yellow to yellow pwdr.

moisture sensitive, (store cold)

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



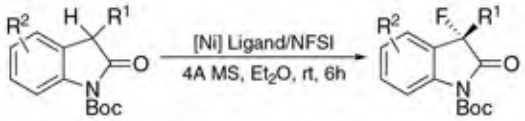
25mg
100mg

Technical Notes:

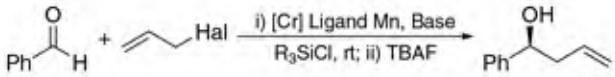
1. Ligand for the Ni-catalzyed enantioselective fluorination of oxindoles.
2. Ligand used in Nozaki-Hiyama-Kishi reaction.

NITROGEN (Compounds)

07-1068 ***(continued)*** **(1Z,3Z)-1,3-Bis[[(4S)-4,5-dihydro-4-(tert-butyl)-2-oxazolyl]methylene]-2,3-dihydro-1H-isoindole, 98%** *(1361563-41-8)*



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (1)

References:

1. *Chem. Eur. J.* **2011**, *17*, 14922.

07-8230

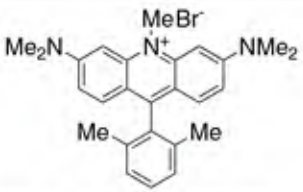
NEW

3,6-Bis(dimethylamino)-9-(2,6-dimethylphenyl)-10-methylacridin-10-ium bromide, min. 95% *(2380163-04-0)*

$C_{26}H_{30}BrN_3$; FW: 464.45; orange to red to dark red solid

air sensitive

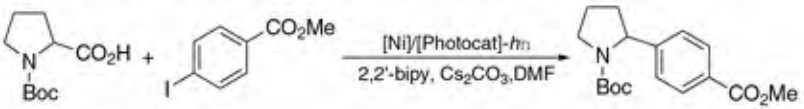
Note: Sold in collaboration with Solvias for research purposes only.



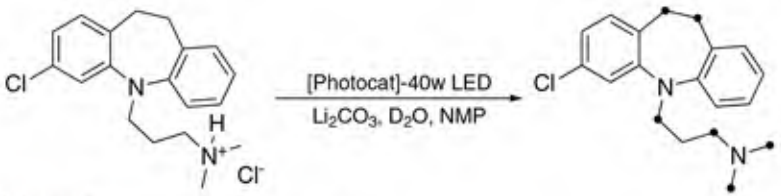
50mg
250mg

Technical Notes:

1. Organophotoredox catalyst used in Ni-assisted C-C cross-coupling without C-O bond formation.
2. Acridinium catalysts used for photoredox deuteration of clomipramine.



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



Tech. Note (2)
Ref. (2)

References:

1. *Angew. Chem. Int. Ed.* **2018**, *57*, 2436.
2. *Synthesis* **2019**, *51*, 4359.
3. *ACS Catal.* **2020**, *10*, 210.

07-8225

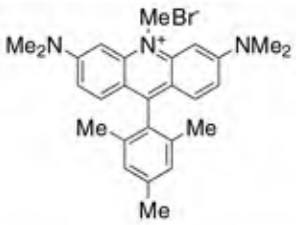
NEW

3,6-Bis(dimethylamino)-9-mesityl-10-methylacridin-10-ium bromide, min. 95% *(2180894-90-8)*

$C_{27}H_{32}BrN_3$; FW: 478.48; orange to red to dark red solid

air sensitive

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



50mg
250mg

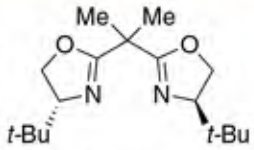
Technical Note:

1. See 07-8230 (page 29)

NITROGEN (Compounds)

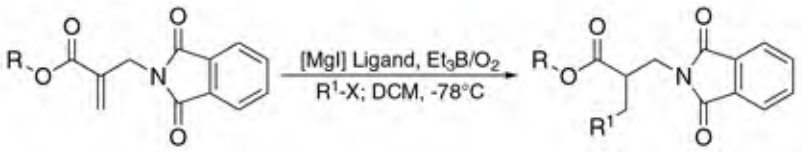
07-1058 NEW

2,2-Bis[(4R)-4-tert-butyl-2-oxazolin-2-yl] propane, 98%, (99% ee) *(131833-97-1)*
$C_{17}H_{30}N_2O_2$; FW: 294.4; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.

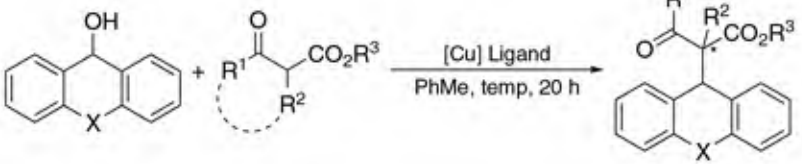


100mg

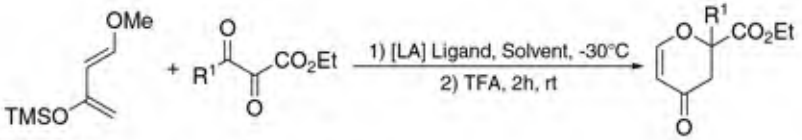
Technical Notes:
1. Ligand for the enantioselective H-atom transfer Reactions to generate β2-amino acids.
2. Ligand for the Cu-catalyzed asymmetric alkylation of β-keto esters with xanthydrols.
3. Ligand used in Zn-catalyzed asymmetric hetero-Diels-Alder reaction of trans-1-methoxy-3-trimethylsilyloxy-buta-1,3-diene.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

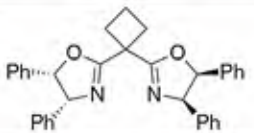


Tech. Note (3)
Ref. (3)

References:
1. *Angew. Chem. Int. Ed.* **2004**, *43*, 1235.
2. *Adv. Synth. Catal.* **2013**, *355*, 2815.
3. *Eur. J. Org. Chem.* **2020**, 5388.

07-1076 NEW

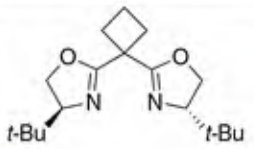
(4R,4'R,5S,5'S)-2,2'-Cyclobutylidenebis[4,5-dihydro-4,5-diphenyloxazole], 98%
$C_{34}H_{30}N_2O_2$; FW: 498.6; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



25mg
100mg

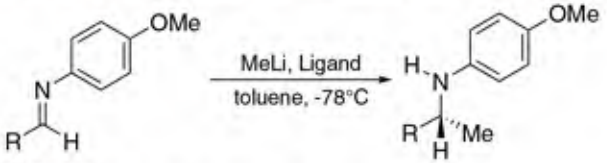
07-1079 NEW

(4S,4'S)-2,2'-Cyclobutylidenebis[4,5-dihydro-4-tert-butyloxazole], min. 95% *(298693-02-4)*
$C_{18}H_{30}N_2O_2$; FW: 306.4; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



25mg
100mg

Technical Note:
1. Ligand used in the enantioselective organolithium additions to imines.



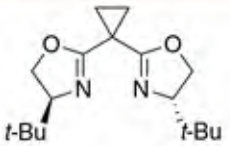
Tech. Note (1)
Ref. (1)

References:
1. *Adv. Synth. Catal.* **2008**, *350*, 1023.

NITROGEN (Compounds)

07-1062 NEW

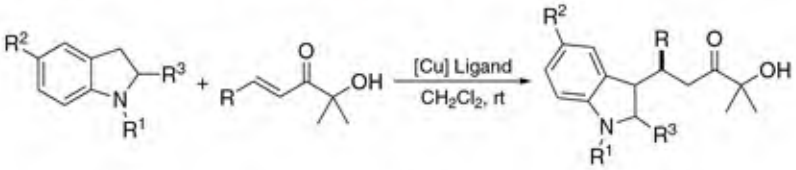
(4S,4'S)-2,2'-Cyclopropylidenebis[4-tert-butyl-4,5-dihydrooxazole], 95% *(195379-09-0)*
$C_{17}H_{28}N_2O_2$; FW: 292.4; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.



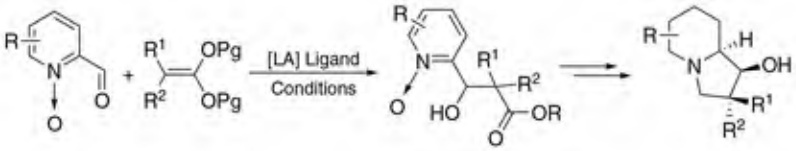
25mg
100mg

Technical Notes:

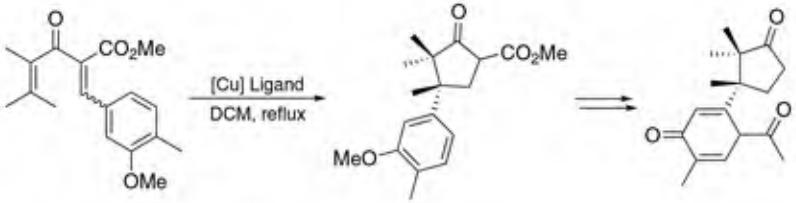
1. Ligand for the highly enantioselective Cu-catalyzed Friedel-Crafts alkylations of pyrroles and indoles with α'-hydroxy enones.
2. Ligand used in Lewis acid catalyzed Aldol reactions to generate optically active pyridine derivatives from prochiral pyridine-N-oxides.
3. Ligand used in Cu-catalyzed tandem Nazarov cyclization/Wagner-Meerwein rearrangement to synthesize Enokipodin B.
4. Ligand used in enantioselective Cu-catalyzed oxy-alkynylation of diazo compounds.
5. Ligand used in Cu-catalyzed oxyvinylation of diazo compounds.



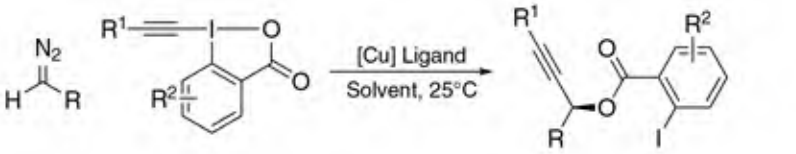
Tech. Note (1)
Ref. (1)



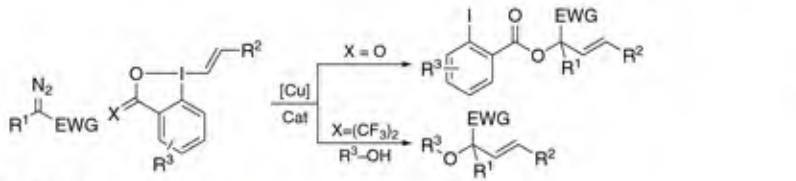
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

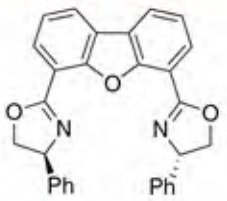
References:

1. *J. Am. Chem. Soc.* **2005**, *127*, 4154.
2. *Chem. Eur. J.* **2006**, *12*, 3472.
3. *Chem. Eur. J.* **2013**, *19*, 4835.
4. *J. Am. Chem. Soc.* **2017**, *139*, 8420.
5. *Org. Lett.* **2020**, *22*, 3884.

NITROGEN (Compounds)

07-1073 NEW

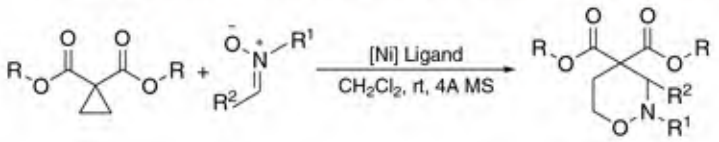
(4S,4'S)-2,2'-(4,6-Dibenzofurandiyl)bis[4,5-dihydro-4-phenyloxazole], 98% *(246040-77-7)*
$C_{36}H_{22}N_2O_3$; FW: 458.5; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



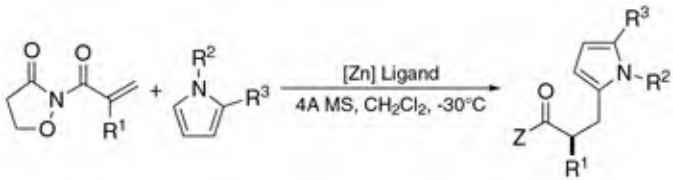
25mg
100mg

Technical Notes:

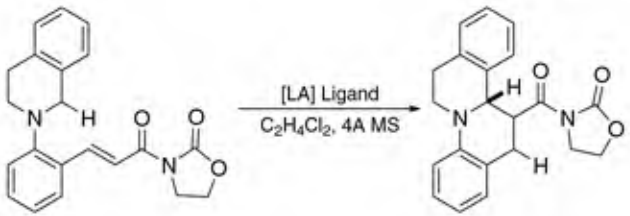
1. Ligand for the Ni-catalyzed enantioselective addition of nitrones to activated cyclopropanes.
2. Ligand for the Zn-catalyzed Friedel-Crafts alkylation with α-substituted acrylates.
3. Ligand for the Lewis acid mediated enantioselective intramolecular redox reactions to generate ring-fused tetrahydroquinolines.
4. Ligand for the Lews acid-catalyzed highly enantioselective α-cyanation with 4-acetylphenyl cyanate.
5. Ligand for the Ni-catalyzed asymmetric 1,3-dipolar cycloaddition of β-fluoroalkylated α,β-Unsaturated 2-pyridylsulfones with nitrones to generate chiral fluoroalkylated isoxazolidines and γ-amino alcohols.



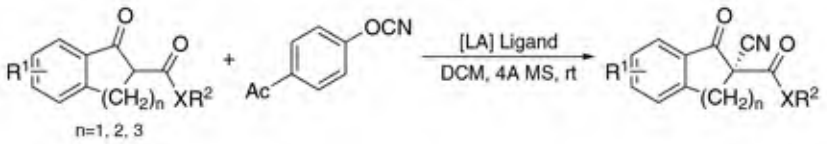
Tech. Note (1)
Ref. (1)



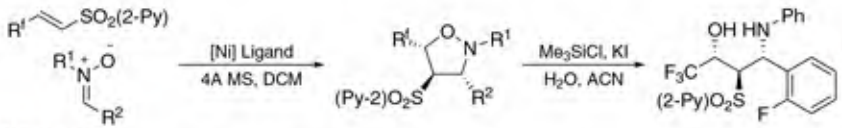
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

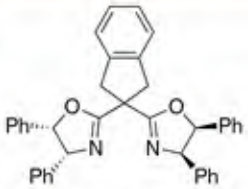
References:

1. *J. Am. Chem. Soc.* **2005**, *127*, 5764.
2. *Angew. Chem. Int. Ed.* **2008**, *47*, 9913.
3. *J. Am. Chem. Soc.* **2009**, *131*, 13226.
4. *Chem. Eur. J.* **2017**, *23*, 1775.
5. *Angew. Chem. Int. Ed.* **2017**, *56*, 1510.

NITROGEN (Compounds)

07-1085 NEW

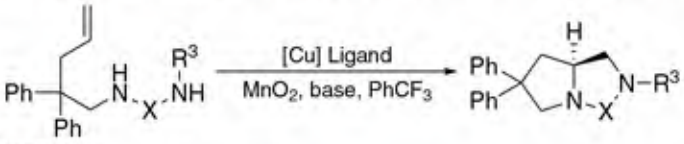
(4R,4'R,5S,5'S)-2,2'-(1,3-Dihydro-2H-inden-2-ylidene)bis[4,5-dihydro-4,5-diphenyloxazole], 98% *(1656253-81-4)*
$C_{39}H_{32}N_2O_2$; FW: 560.7; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



25mg
100mg

Technical Note:

1. Ligand used in Cu(II)-catalyzed enantioselective intramolecular cyclization of N-alkenylureas.



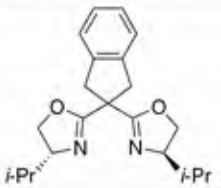
Tech. Note (1)
Ref. (1)

References:

1. *Org. Lett.* **2015**, *17*, 1018.

07-1434 NEW

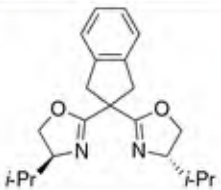
(4R,4'R)-2,2'-(1,3-Dihydro-2H-inden-2-ylidene) bis[4,5-dihydro-4-isopropyloxazole], 98%, (99% ee)
$C_{21}H_{28}N_2O_2$; FW: 340.5; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



100mg

07-1435 NEW

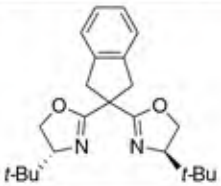
(4S,4'S)-2,2'-(1,3-Dihydro-2H-inden-2-ylidene) bis[4,5-dihydro-4-isopropyloxazole], 98%, (99% ee)
$C_{21}H_{28}N_2O_2$; FW: 340.5; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



100mg

07-1082 NEW

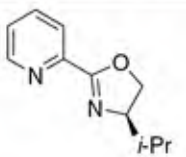
(4R,4'R)-2,2'-(1,3-Dihydro-2H-inden-2-ylidene) bis[4,5-dihydro-4-tert-butyloxazole], 98%, (99% ee)
$C_{23}H_{32}N_2O_2$; FW: 368.5; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



100mg

07-1049 NEW

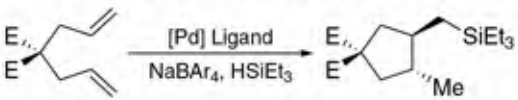
2-[(4R)-4,5-Dihydro-4-isopropyl-2-oxazolyl] pyridine, 98% (99% ee) *(132187-16-7)*
$C_{11}H_{14}N_2O$; FW: 190.2; light yellow to yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.



100mg

Technical Note:

1. Ligand for the Pd-catalyzed enantioselective diene cyclization/hydrosilylation.



Tech. Note (1)
Ref. (1)

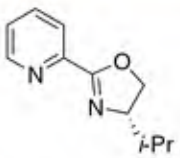
References:

1. *J. Org. Chem.* **2000**, *65*, 3836.

NITROGEN (Compounds)

07-1048 NEW

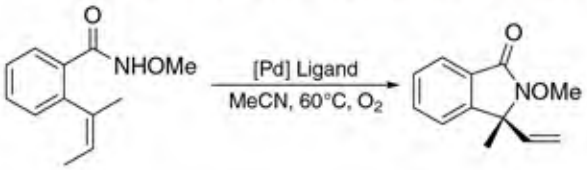
2-[(4S)-4,5-Dihydro-4-isopropyl-2-oxazolyl] pyridine, 98%, (99% ee) *(108915-04-4)*
$C_{11}H_{14}N_2O$; FW: 190.2; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.



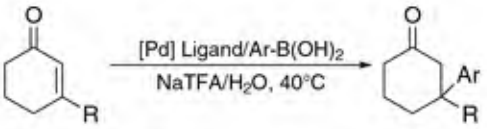
100mg

Technical Notes:

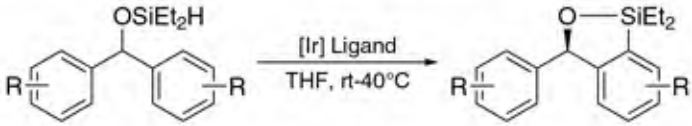
1. Ligand used in the Pd-catalyzed asymmetric aerobic Aza-Wacker-Type cyclization.
2. Ligand used in Pd-catalyzed conjugate addition of arylboronic acids to β-substituted cyclic enones.
3. Ligand for enantioselective Ir-catalyzed silylation of aromatic C–H bonds.
4. Ligand for the Co-catalyzed enantioselective Markovnikov 1,2-hydrosilylation of conjugated dienes.
5. Ligand used for the Ni-catalyzed intramolecular desymmetrization addition of aryl halides to 1,3-diketones.



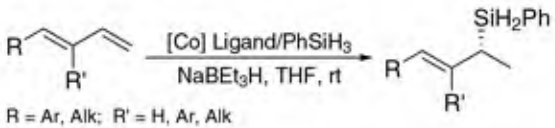
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

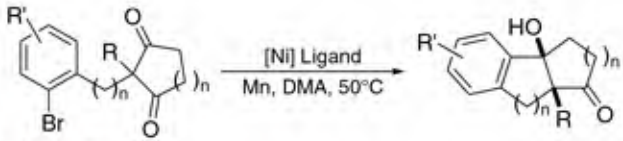


Tech. Note (3)
Ref. (3)



R = Ar, Alk; R' = H, Ar, Alk

Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

References:

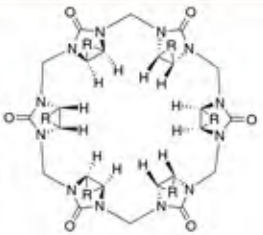
1. *Angew. Chem. Int. Ed.* **2012**, *51*, 9141.
2. *J. Am. Chem. Soc.* **2013**, *135*, 14996.
3. *Angew. Chem. Int. Ed.* **2017**, *56*, 1092.
4. *ACS Catal.* **2019**, *9*, 1612.
5. *Chem. Commun.*, **2020**, *56*, 8194.

NITROGEN (Compounds)

07-1340 NEW

Dodecabenzylbambus[6]uril, Bn-BU[6]
(1308315-95-8)
$C_{114}H_{108}N_{24}O_{12}$; FW: 2006.23; white pwdr.
Note: Patents: CZ302710B6, EP2501699B1, US8779120, WO2011057590A1.

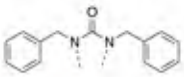
100mg



Technical Notes:

1. Exhibits exceptionally strong binding of anions with different sizes in chloroform.
2. Macrocycle used in the real-time analysis of anion mixtures by NMR methods.
3. Used as a transmembrane Cl-/HCO3- antiporter.
4. Used as a carrier in tailor-made liquid membranes for highly selective electromembrane extractions of inorganic anions.
5. Used for anion complexation in the study of the influence of counterions on the [N-I-N]+ halogen bond in solution, in the solid state and in silico.

R =



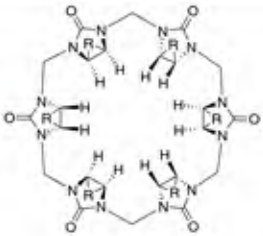
References:

1. *ChemPlusChem.*, **2015**, *80*, 1601-1606.
2. *Chem. Commun.*, **2015**, *51*, 4666.
3. *Chem*, **2019**, *5*, 429-444.
4. *Anal. Chim. Acta*, **2017**, *950*, 49-56.
5. *Chem. Sci.*, **2015**, *6*, 3746-3756.

07-1342 NEW

Dodecamethylbambus[6]uril hydrate, BU[6]
(1227292-62-7)
$C_{42}H_{60}N_{24}O_{12}{\cdot}XH_2O$; FW: 1093.08 ; white pwdr.
Note: Patents: CZ302710B6, EP2501699B1, US8779120, WO2011057590A1.

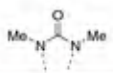
100mg



Technical Note:

1. A new macrocyclic compound which is able to bind anions with high affinity and selectivity.

R =



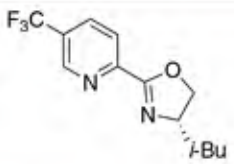
References:

1. *Chem. Eur. J.*, **2011**, *17*, 5605-5612.
2. *Org. Lett.*, **2011**, *13(15)*, 4000.

07-1041 NEW

2-[(4S)-4-Isobutyl-4,5-dihydro-2-oxazolyl]-5-(trifluoromethyl)pyridine, 98%, (99% ee)
$C_{13}H_{15}F_3N_2O$; FW: 272.3; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only

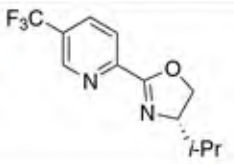
100mg



07-7059 NEW

2-[(4S)-4-Isopropyl-4,5-dihydro-2-oxazolyl]-5-(trifluoromethyl)pyridine, 98%, (99% ee)
$C_{12}H_{13}F_3N_2O$; FW: 258.2; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.

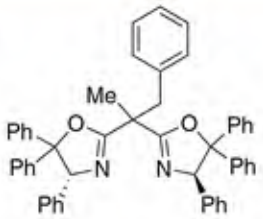
100mg



NITROGEN (Compounds)

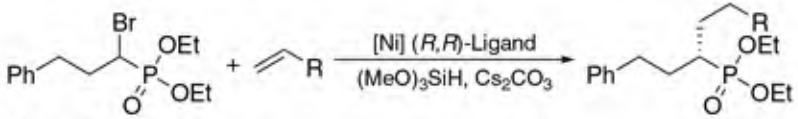
07-1088 NEW

(4R,4'R)-2,2'-(1-Phenylpropane-2,2-diyl) bis(4,5,5-triphenyl-4,5-dihydrooxazole), 98% *(2409652-69-1)*
$C_{51}H_{42}N_2O_2$; FW: 714.9; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



25mg
100mg

Technical Note:
1. Ligand for the Ni-catalyzed enantioconvergent reductive hydroalkylation of olefins with α-heteroatom phosphorus alkyl electrophiles.

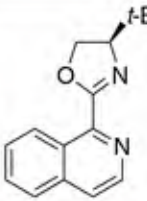


Tech. Note (1)
Ref. (1)

References:
1. *J. Am. Chem. Soc.* **2020**, *142*, 214.

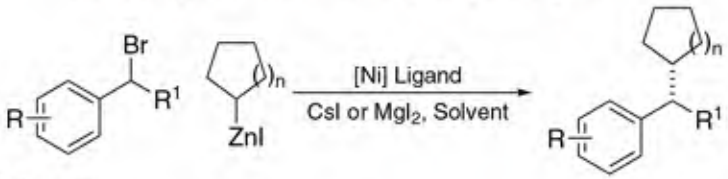
07-1055 NEW

1-[(4R)-4-tert-Butyl-4,5-dihydro-2-oxazolyl] isoquinoline, 98%, (99% ee) *(1402851-53-9)*
$C_{16}H_{18}N_2O$; FW: 254.3; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

Technical Note:
1. Ligand for the Ni-catalyzed asymmetric cross-coupling of secondary electrophiles with secondary nucleophiles, specifically, stereoconvergent Negishi reactions of racemic benzylic bromides with achiral cycloalkylzinc reagents.

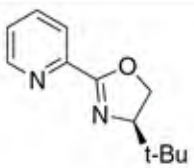


Tech. Note (1)
Ref. (1)

References:
1. *J. Am. Chem. Soc.* **2012**, *134*, 17003.

07-1045 NEW

2-[(4R)-4-tert-Butyl-4,5-dihydro-2-oxazolyl] pyridine, 95%, (99% ee) *(242482-28-6)*
$C_{12}H_{16}N_2O$; FW: 204.3; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only

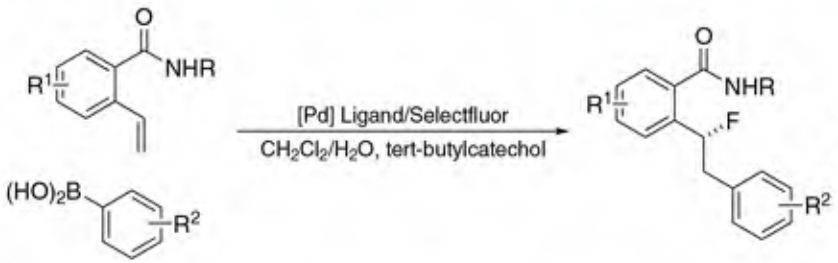


25mg
100mg

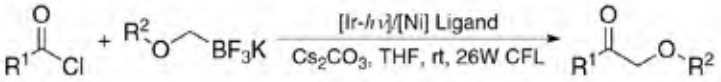
Technical Notes:
1. Ligand for asymmetric Pd-catalyzed directed intermolecular fluoroarylation of styrenes.
2. Ligand used in Ir visible light photoredox/Ni-catalyzed cross-coupling of acyl chlorides with potassium alkoxymethyltrifluoroborates.
3. Ligand for Ni-catalyzed asymmetric intramolecular reductive Heck reaction of unactivated alkenes.
4. Ligand used in Au(III)-catalyzed intramolecular alkoxycyclization of a 1,6-enyne.
5. Ligand for the Ni-catalyzed asymmetric reductive arylbenzylation of unactivated alkene.

NITROGEN (Compounds)

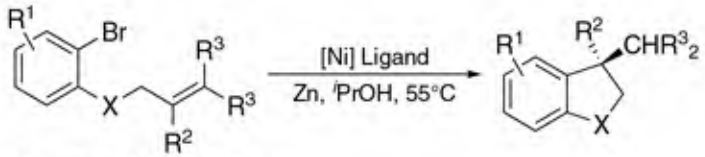
07-1045 **2-[(4R)-4-tert-Butyl-4,5-dihydro-2-oxazolyl]pyridine, 95%, (99% ee)** *(242482-28-6)*
(continued)



Tech. Note (1)
Ref. (1)

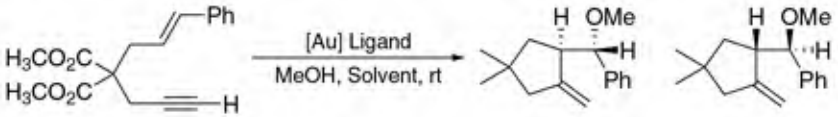


Tech. Note (2)
Ref. (2)

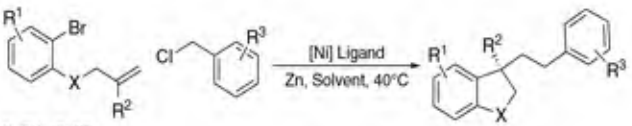


R_3= H or D; X=CH_2, O, NTs

Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



X=CH_2, O, NTs

Tech. Note (5)
Ref. (5)

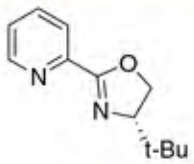
References:

1. *J. Am. Chem. Soc.* **2014**, *136*, 4101.
2. *Org. Lett.* **2016**, *18*, 732.
3. *Org. Lett.* **2019**, *21*, 6989.
4. *J. Am. Chem. Soc.* **2019**, *141*, 18221.
5. *Org. Lett.* **2020**, *22*, 2724.

NITROGEN (Compounds)

07-1044 NEW

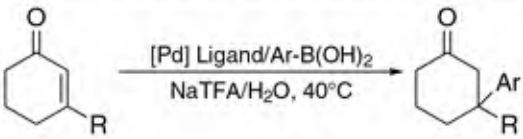
2-[(4S)-4-tert-Butyl-4,5-dihydro-2-oxazolyl] pyridine, 98%, (99% ee) *(117408-98-7)*
$C_{12}H_{16}N_2O$; FW: 204.3; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only



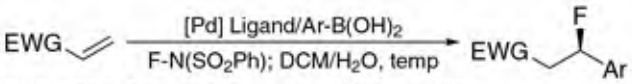
100mg

Technical Notes:

1. Ligand used in Pd-catalyzed conjugate addition of arylboronic acids to β-substituted cyclic enones.
2. Ligand for the enantioselective Pd-catalyzed oxidative β,β-fluoroarylation of α,β-unsaturated carbonyl derivatives.
3. Ligand for the Pd-catalyzed asymmetric Aza-Wacker-Type cyclization of N-Ts hydrazine-tethered tetrasubstituted olefins.
4. Ligand for the Co-catalyzed enantioselective Markovnikov 1,2-hydrosilylation of conjugated dienes.
5. Ligand for the Pd-catalyzed enantioselective desymmetrization of polycyclic cyclohexenediones.

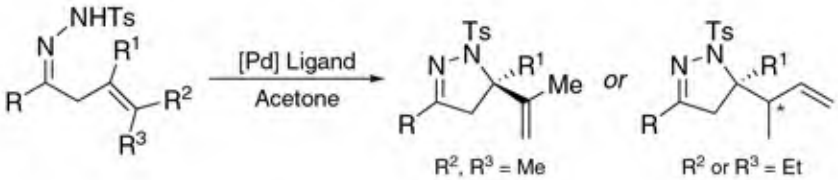


Tech. Note (1)
Ref. (1)

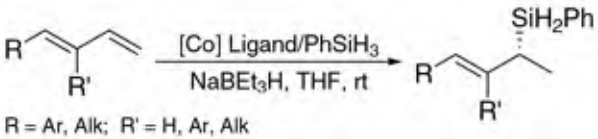


EWG = COR, CO_2R, $CONR_1R_2$, CO_2H, CH_2CN, CHO

Tech. Note (2)
Ref. (2)

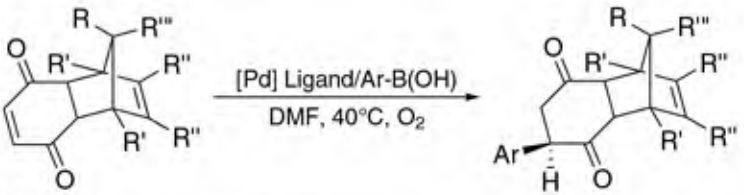


Tech. Note (3)
Ref. (3)



R = Ar, Alk; R' = H, Ar, Alk

Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

References:

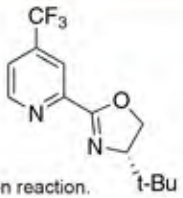
1. *J. Am. Chem. Soc.* **2013**, *135*, 14996.
2. *Angew. Chem. Int. Ed.* **2016**, *55*, 9045
3. *J. Am. Chem. Soc.* **2018**, *140*, 7587.
4. *ACS Catal.* **2019**, *9*, 1612.
5. *Org. Lett.* **2019**, *21*, 8689.

NITROGEN (Compounds)

07-1050 NEW

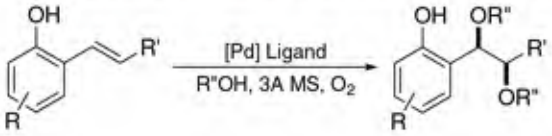
2-[(4S)-4-tert-Butyl-4,5-dihydro-2-oxazolyl]-4-(trifluoromethyl)pyridine, 98% *(1257527-14-2)*
$C_{13}H_{15}F_3N_2O$; FW: 272.3; off white to light yellow pwdr.
moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.

100mg

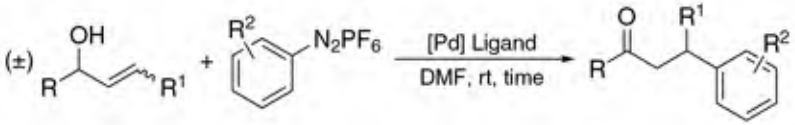


Technical Notes:

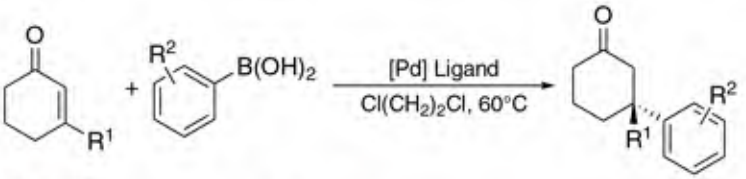
1. Ligand used in enantioselective Pd-catalyzed alkene difunctionalization reaction.
2. Ligand used in enantioselectiv Pd-catalyzed alkene arylations of acyclic alkenyl alcohols.
3. Ligand for enantioselectiv Pd-catalyzed conjugate addition of arylboronic acids to β-substituted cyclic enones.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

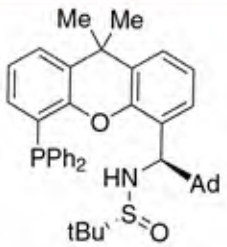
1. *J. Am. Chem. Soc.* **2010**, *132*, 17471.
2. *Science* **2012**, *338*, 1455.
3. *J. Am. Chem. Soc.* **2013**, *135*, 14996.

PHOSPHORUS (Compounds)

15-8406 NEW

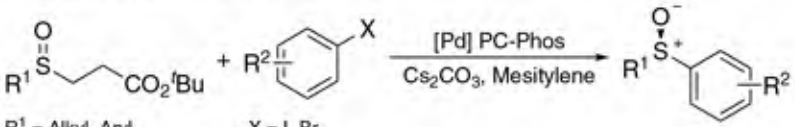
[S(R)]-N-((1R)-(Adamantan-1-yl)(5-(diphenylphosphanyl)-9,9-dimethyl-9H-xanthen-4-yl)methyl)-2-methyl-2-propanesulfinamide, 95% *(2162939-91-3)*
$C_{42}H_{48}NO_2PS$; FW: 661.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

25mg



Technical Note:

1. Ligand for the Pd-catalyzed enantioselective arylation of general sulfenate anions.



Tech. Note (1)
Ref. (1)

R^1 = Alkyl, Aryl X = I, Br

References:

1. *J. Am. Chem. Soc.* **2018**, *140*, 3467.

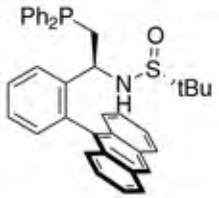
PHOSPHORUS (Compounds)

15-8404 NEW — **[S(R)]-N-((1S)-(Adamantan-1-yl)(5-(diphenylphosphanyl)-9,9-dimethyl-9H-xanthen-4-yl)methyl)-2-methyl-2-propanesulfinamide, 95%** *(2183514-08-9)* — 50mg

$C_{42}H_{48}NO_2PS$; FW: 661.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

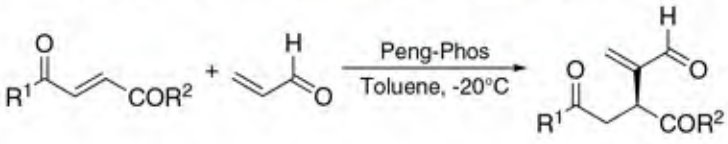
Technical Note:
1. See 15-8406 (page 39)

15-8370 NEW — **[S(R)]-N-[(1S)-1-[2-(9-Anthracenyl) phenyl]-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95%** *(1936438-22-0)* — 50mg

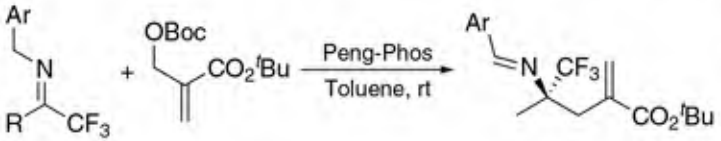


$C_{38}H_{36}NOPS$; FW: 585.7
air sensitive, moisture sensitive, (store cold)
Note: Sold in collaboration with Daicel for research purposes only.

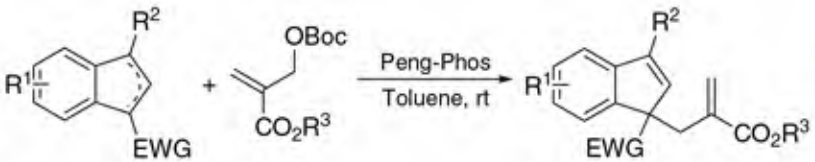
Technical Notes:
1. Organocatalyst used in enantioselective intermolecular cross Rauhut-Currier reactions of activated alkenes with acrolein.
2. Used in phosphine-catalyzed asymmetric umpolung addition of trifluoromethyl ketimines to Morita-Baylis-Hillman carbonates.
3. Used in the enantioselective phosphine-catalyzed allylic alkylations of mix-indene with MBH carbonates.
4. Used in phosphine-catalyzed asymmetric synthesis of α-quaternary amine via umpolung γ-addition of ketimines to allenoates.
5. Ligand for the direct Pd-catalyzed cross-coupling reaction of easily accessible secondary phosphine oxides and aryl bromides, which provides rapid access to P-chiral phosphine oxides.



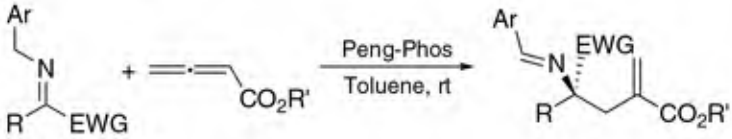
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

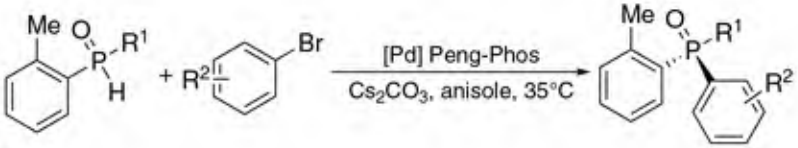


Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

EWG = CF_3, ester



Tech. Note (5)
Ref. (5)

PHOSPHORUS (Compounds)

15-8370 ***(continued)*** **[S(R)]-N-[(1S)-1-[2-(9-Anthracenyl)phenyl]-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95%** *(1936438-22-0)*

References:

1. *Chem. Commun.*, **2016**, *52*, 7612.
2. *Angew. Chem. Int. Ed.* **2016**, *55*, 13316.
3. *Org. Lett.* **2017**, *19*, 6080.
4. *Org. Lett.* **2017**, *19*, 6550.
5. *J. Am. Chem. Soc.* **2019**, *141*, 20556.

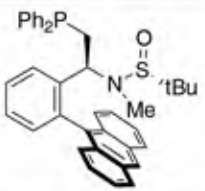
15-8380 NEW

[S(R)]-N-[(1S)-1-[2-(9-Anthracenyl)phenyl]-2-(diphenylphosphino)ethyl]-N,2-dimethyl-2-propanesulfinamide, 95%

$C_{39}H_{38}NOPS$; FW: 599.8; white to off-white pwdr.

air sensitive, moisture sensitive

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



50mg

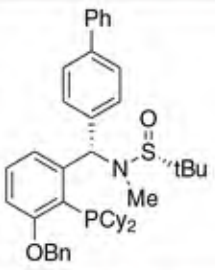
15-8478 NEW

[S(R)]-N-[(S)-[(3-(Benzyloxy)-2-(dicyclohexylphosphino)phenyl]-(1,1'-biphenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%

$C_{43}H_{54}NO_2PS$; FW: 679.9; white to off-white pwdr.

air sensitive, moisture sensitive

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



25mg

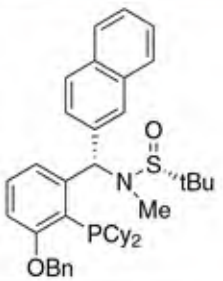
15-8482 NEW

[S(R)]-N-[(S)-[3-(Benzyloxy)-2-(dicyclohexylphosphino)phenyl]-(2-naphthalenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%

$C_{41}H_{52}NO_2PS$; FW: 653.9; white to off-white pwdr.

air sensitive, moisture sensitive

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



25mg

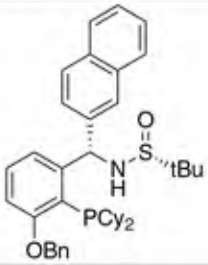
15-8480 NEW

[S(R)]-N-[(S)-[3-(Benzyloxy)-2-(dicyclohexylphosphino)phenyl]-(2-naphthalenyl)methyl]-2-methyl-2-propanesulfinamide, 95%

$C_{40}H_{50}NO_2PS$; FW: 639.9; white to off-white pwdr.

air sensitive, moisture sensitive

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



25mg

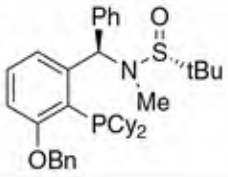
15-8476 NEW

[S(R)]-N-[(R)-[(3-(Benzyloxy)-2-(dicyclohexylphosphino)phenyl)phenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%

$C_{37}H_{50}NO_2PS$; FW: 603.8; white to off-white pwdr.

air sensitive, moisture sensitive

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



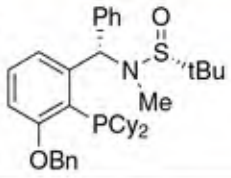
25mg

PHOSPHORUS (Compounds)

15-8474 NEW — 25mg

[S(R)]-N-[(S)-[(3-(Benzyloxy)-2-(dicyclohexylphosphino)phenyl)phenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%

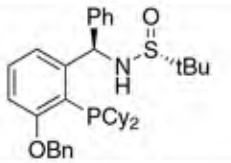
$C_{37}H_{50}NO_2PS$; FW: 603.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8472 NEW — 25mg

[S(R)]-N-[(R)-[(3-(Benzyloxy)-2-(dicyclohexylphosphino)phenyl)phenylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{36}H_{48}NO_2PS$; FW: 589.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8470 NEW — 25mg

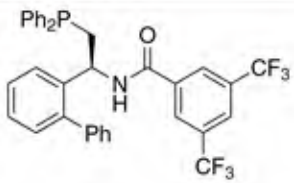
[S(R)]-N-[(S)-[(3-(Benzyloxy)-2-(dicyclohexylphosphino)phenyl)phenylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{36}H_{48}NO_2PS$; FW: 589.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

15-8506 NEW — 50mg

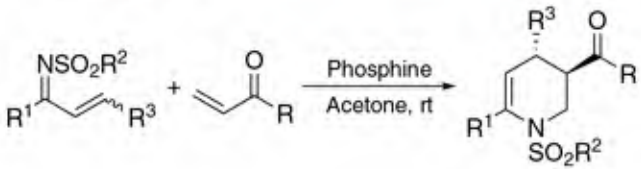
N-[(1S)-1-[1,1'-Biphenyl]-2-yl-2-(diphenylphosphino)ethyl]-3,5-bis(trifluoromethyl)-benzamide, 95% *(2089424-10-0)*

$C_{36}H_{26}F_6NOP$; FW: 621.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

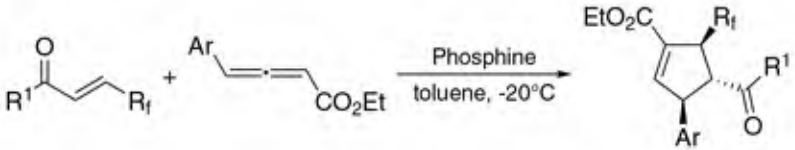


Technical Notes:

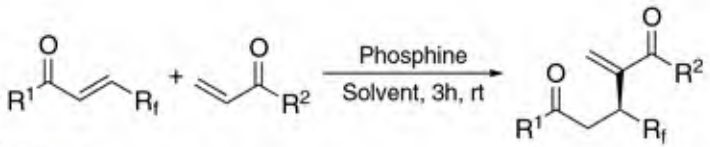
1. Organocatalyst used in aza-[4+2] cycloaddition of N-sulfonyl-1-aza-1,3-dienes with vinyl ketones.
2. Catalyst for the enantioselective [3+2] cycloadditions of γ-substituted allenoates with β-perfluoroalkyl enones.
3. Catalyst for asymmetric intermolecular cross Rauhut-Currier reaction of β-perfluoroalkyl-substituted enones and vinyl ketones.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

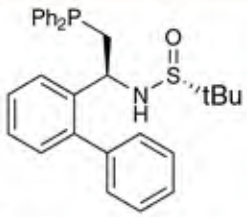
1. *Org. Lett.* **2017**, *19*, 1710.
2. *Chem. Sci.*, **2017**, *8*, 4660.
3. *Adv. Synth. Catal.* **2017**, *359*, 3347.

PHOSPHORUS (Compounds)

15-8368 NEW

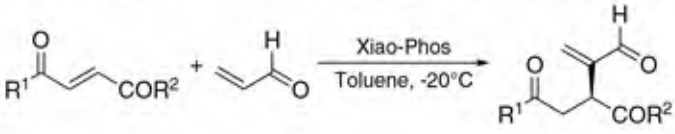
[S(R)]-N-[(1S)-1-[1,1'-Biphenyl]-2-yl-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95% *(1936438-14-0)*
$C_{30}H_{32}NOPS$; FW: 485.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

100mg

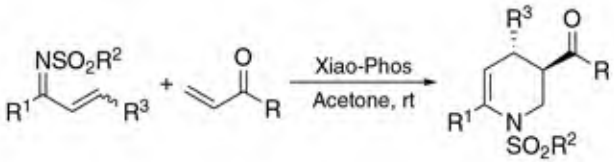


Technical Notes:

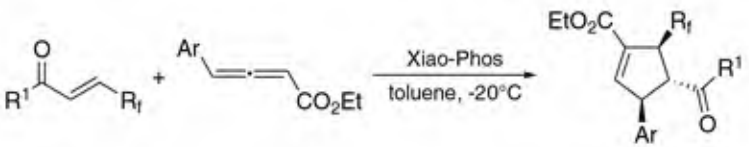
1. Organocatalyst used in enantioselective intermolecular cross Rauhut-Currier reactions of activated alkenes with acrolein.
2. Organocatalyst used in aza-[4+2] cycloaddition of N-sulfonyl-1-aza-1,3-dienes with vinyl ketones.
3. Catalyst for the enantioselective [3+2] cycloadditions of γ-substituted allenoates with β-perfluoroalkyl enones.
4. Ligand for the direct Pd-catalyzed cross-coupling reaction of easily accessible secondary phosphine oxides and aryl bromides, which provides rapid access to P-chiral phosphine oxides.



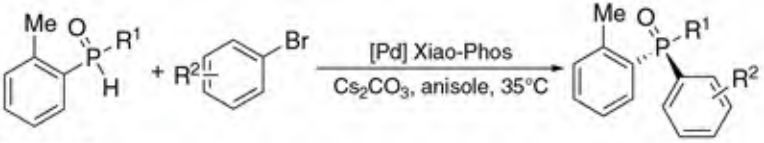
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

References:

1. *Chem. Commun.*, **2016**, *52*, 7612.
2. *Org. Lett.* **2017**, *19*, 1710.
3. *Chem. Sci.*, **2017**, *8*, 4660.
4. *J. Am. Chem. Soc.* **2019**, *141*, 20556.

PHOSPHORUS (Compounds)

15-8520 NEW

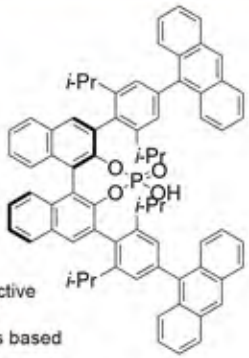
(11bR)-2,6-Bis[4-(9-anthracenyl)-2,6-bis(isopropyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 95%, (99% ee)

(1236191-19-7)

$C_{72}H_{61}O_4P$; FW: 1021.2; off white to light yellow pwdr.

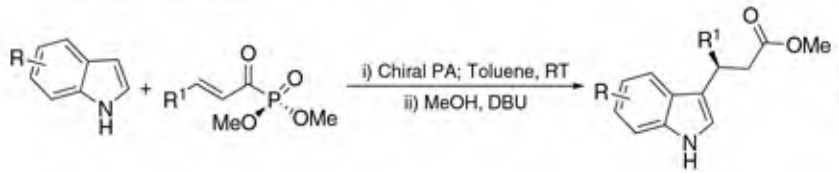
Note: Sold in collaboration with Daicel for research purposes only.

10mg
25mg

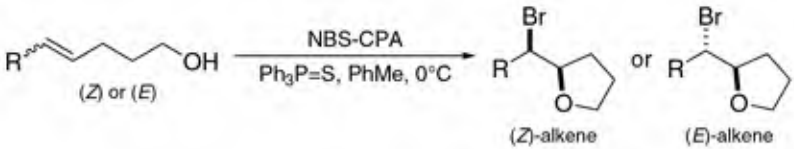


Technical Notes:

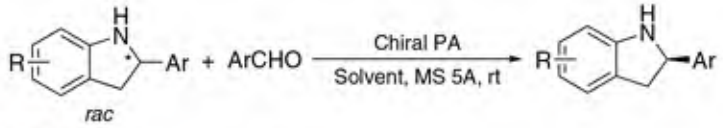
1. Organocatalyst for enantioselective Friedel-Crafts alkylation reaction of indoles with α,β-unsaturated acyl phosphonates.
2. Used in the Lewis base/chiral Brønsted acid catalyzed enantioselective bromocycloetherification.
3. Chiral phosphoric acid catalyst for the kinetic resolution of indolines based on a self-redox reaction.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

1. *Chem. Commun.* **2010**, *46*, 4112.
2. *Org. Lett.*, **2012**, *14*, 256.
3. *Angew. Chem. Int. Ed.* **2016**, *55*, 3148.

15-8521 NEW

(11bS)-2,6-Bis[4-(9-anthracenyl)-2,6-bis(isopropyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 95%, (99% ee)

(1051435-82-5)

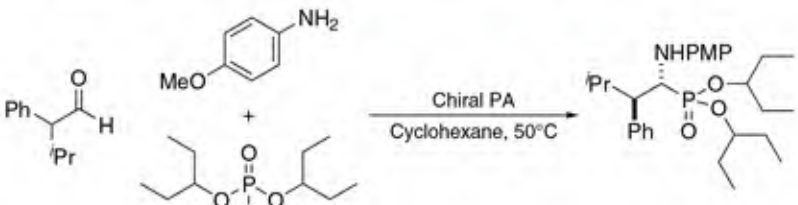
$C_{72}H_{61}O_4P$; FW: 1021.2; off white to light yellow pwdr.

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

10mg
25mg

Technical Notes:

1. Used in direct Brønsted acid catalyzed asymmetric three-component Kabachnik-Fields reaction.
2. Used in direct catalytic asymmetric synthesis of cyclic aminals from aldehydes.
3. Brønsted acid catalyst for asymmetric acetalization of aliphatic aldehydes.

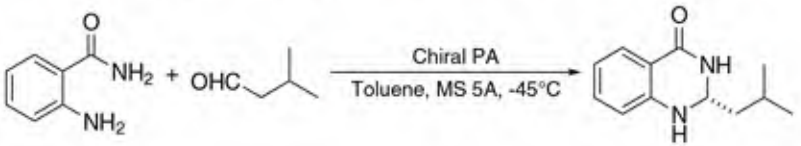


Tech. Note (1)
Ref. (1)

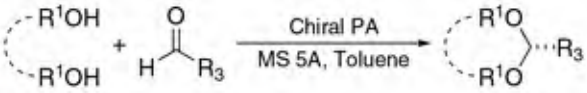
PHOSPHORUS (Compounds)

15-8521 *(continued)*

(11bS)-2,6-Bis[4-(9-anthracenyl)-2,6-bis(isopropyl)phenyl]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 95%, (99% ee) *(1051435-82-5)*



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

1. *Angew. Chem. Int. Ed.* **2013**, *52*, 4474.
2. *J. Am. Chem. Soc.* **2008**, *130*, 15786.
3. *Angew. Chem. Int. Ed.* **2008**, *47*, 5079.

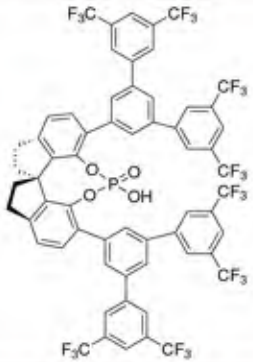
15-0564

NEW

(11aS)-3,7-Bis[3,5-bis[3,5-bis(trifluoromethyl)phenyl]phenyl]-10,11,12,13-tetrahydro-5-hydroxy-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)

$C_{61}H_{31}F_{24}O_4P$; FW: 1314.8; off white to light yellow pwdr.

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



25mg
100mg

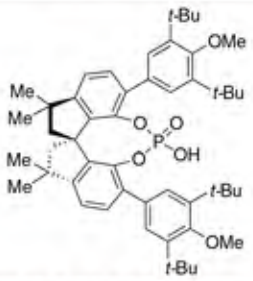
15-8588

NEW

(11aR)-3,7-Bis[3,5-bis(tert-butyl)-4-methoxyphenyl]-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)

$C_{51}H_{67}O_6P$; FW: 807; off white to light yellow pwdr.

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



25mg
100mg

15-8589

NEW

(11aS)-3,7-Bis[3,5-bis(tert-butyl)-4-methoxyphenyl]-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)

$C_{51}H_{67}O_6P$; FW: 807; off white to light yellow pwdr.

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

25mg
100mg

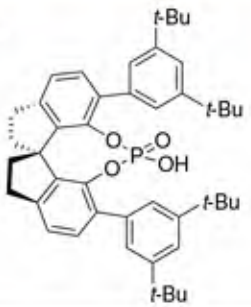
PHOSPHORUS (Compounds)

15-0578 NEW — 25mg

(11aS)-3,7-Bis[3,5-bis(tert-butyl)phenyl]-10,11,12,13-tetrahydro-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)

$C_{45}H_{55}O_4P$; FW: 690.9; off white to light yellow pwdr.

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

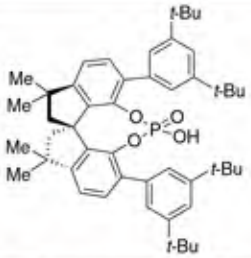


15-8592 NEW — 25mg, 100mg

(11aR)-3,7-Bis[3,5-bis(tert-butyl)phenyl]-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)

$C_{49}H_{63}O_4P$; FW: 747; off white to light yellow pwdr.

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



15-8593 NEW — 25mg, 100mg

(11aS)-3,7-Bis[3,5-bis(tert-butyl)phenyl]-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)

$C_{49}H_{63}O_4P$; FW: 747; off white to light yellow pwdr.

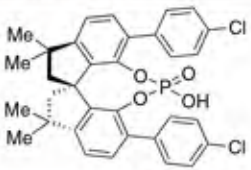
Note: Sold in collaboration with Daicel for research purposes only.

15-8575 NEW — 25mg, 100mg

(11aR)-3,7-Bis(4-chlorophenyl)-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%

$C_{33}H_{29}Cl_2O_4P$; FW: 591.5; off white to light yellow pwdr.

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



15-3360 NEW — 100mg, 500mg

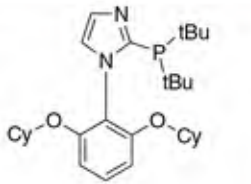
1-[2,6-Bis(cyclohexyloxy)phenyl]-2-(di-tert-butylphosphaneyl)-1H-imidazole, min. 95%

(2179272-79-6)

$C_{29}H_{45}N_2O_2P$; FW: 484.66; white to off-white to pale yellow solid

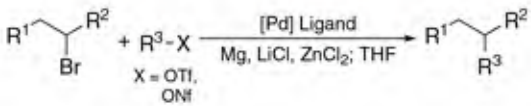
air sensitive

Note: Sold in collaboration with Solvias for research purposes only. Patents: EP 1625133, US 2007/0123707.



Technical Notes:

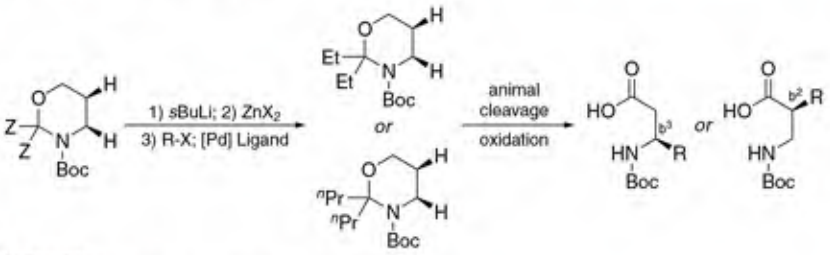
1. Ligand for the Pd-catalyzed Barbier-Negishi coupling of secondary alkyl bromides with aryl and alkenyl triflates and nonaflates.
2. Used in Pd-catalyzed enantioselective synthesis of β2- and β3- amino acids via asymmetric and regiodivergent C-H Functionalization of Boc-1,3-oxazinanes.



Tech. Note (1)
Ref. (1)

PHOSPHORUS (Compounds)

15-3360 **1-[2,6-Bis(cyclohexyloxy)phenyl]-2-(di-tertbutylphosphaneyl)-1H-imidazole, min. 95%**
(continued) *(2179272-79-6)*



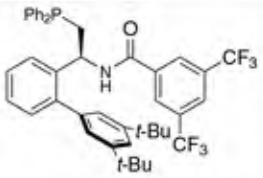
Tech. Note (2)
Ref. (2)

References:
1. *Angew. Chem. Int. Ed.* **2018**, *57*, 1982.
2. *Nat. Catal.* **2019**, *2*, 882.

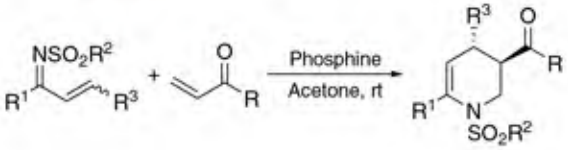
15-8508 50mg

NEW

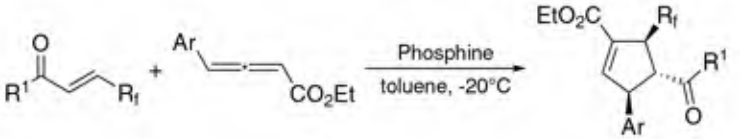
N-[(1S)-1-[3',5'-Bis(1,1-dimethylethyl)[1,1'-biphenyl]-2-yl]-2-(diphenylphosphino)ethyl]-3,5-bis(trifluoromethyl)-benzamide, 95%
(2089424-11-1)
$C_{43}H_{42}F_6NOP$; FW: 733.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



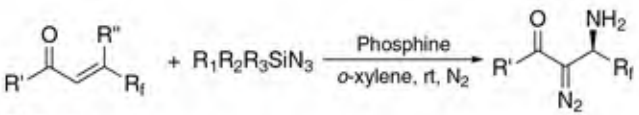
Technical Notes:
1. Organocatalyst used in aza-[4+2] cycloaddition of N-sulfonyl-1-aza-1,3-dienes with vinyl ketones.
2. Catalyst for the enantioselective [3+2] cycloadditions of γ-substituted allenoates with β-perfluoroalkyl enones.
3. Phosphine catalyst for difunctionalization of β-fluoroalkyl α, β-Enones to generate β-amino α-diazo carbonyl compounds.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:
1. *Org. Lett.* **2017**, *19*, 1710.
2. *Chem. Sci.*, **2017**, *8*, 4660.
3. *Angew. Chem. Int. Ed.* **2018**, *57*, 15787.

PHOSPHORUS (Compounds)

15-8372 NEW

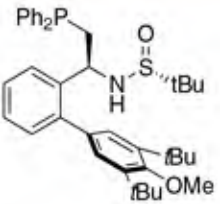
[S(R)]-N-[(1S)-1-[3',5'-Bis(1,1-dimethylethyl)-4'-methoxy[1,1'-biphenyl]-2-yl]-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95% *(1936438-26-4)*

$C_{39}H_{50}NO_2PS$; FW: 627.9; white to off-white pwdr.

air sensitive, moisture sensitive

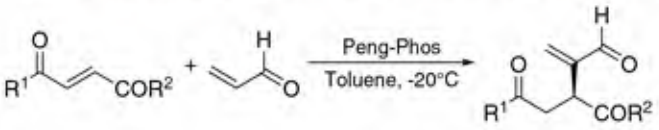
Note: Sold in collaboration with Daicel for research purposes only.

50mg

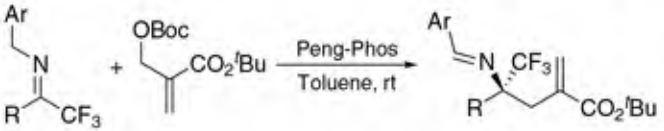


Technical Notes:

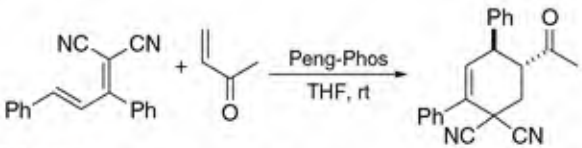
1. Organocatalyst used in enantioselective intermolecular cross Rauhut-Currier reactions of activated alkenes with acrolein.
2. Used in phosphine-catalyzed asymmetric umpolung addition of trifluoromethyl ketimines to Morita-Baylis-Hillman carbonates.
3. Organocatalyst for [4+2] anulation of electron-deficient dienes and vinyl ketones.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

1. *Chem. Commun.*, **2016**, *52*, 7612.
2. *Angew. Chem. Int. Ed.* **2016**, *55*, 13316.
3. *Adv. Synth. Catal.* **2018**, *360*, 682.

15-8438 NEW

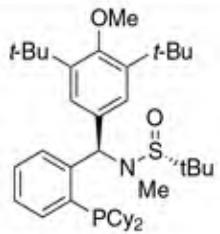
[S(R)]-N-[(R)-[3,5-Bis(1,1-dimethylethyl)-4-methoxyphenyl][2-(dicyclohexylphosphino)phenyl]methyl]-N,2-dimethyl-2-propanesulfinamide, 95%

$C_{39}H_{62}NO_2PS$; FW: 640.0; white to off-white pwdr.

air sensitive, moisture sensitive

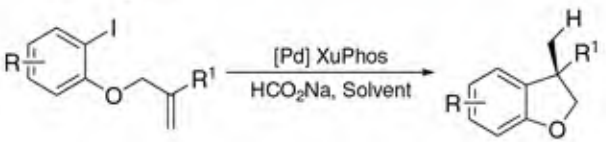
Note: Sold in collaboration with Daicel for research purposes only.

50mg



Technical Notes:

1. Ligand for the Pd-catalyzed enantioselective reductive Heck reactions to generate 3,3-disubstituted 2,3-dihydrobenzofuran.
2. Ligand for the Pd-catalyzed enantioselective carboiodination of olefin-tethered aryl iodides.
3. Ligand for the Pd-catalyzed enantioselective dicarbofunctionalization of unactivated alkenes via Heck-Suzuki coupling reaction.

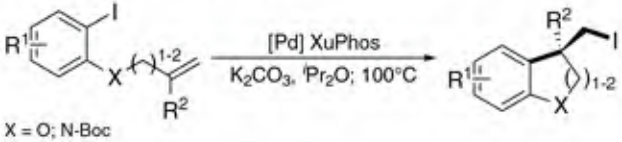


Tech. Note (1)
Ref. (1)

PHOSPHORUS (Compounds)

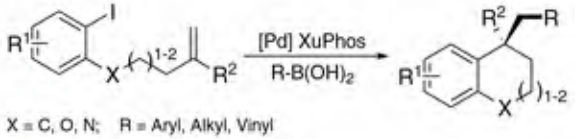
15-8438 *(continued)*

[S(R)]-N-[(R)-[3,5-Bis(1,1-dimethylethyl)-4-methoxyphenyl][2-(dicyclohexylphosphino) phenyl]methyl]-N,2-dimethyl-2-propanesulfinamide, 95%



X = O; N-Boc

Tech. Note (2)
Ref. (2)



X = C, O, N; R = Aryl, Alkyl, Vinyl

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

References:

1. *Angew. Chem. Int. Ed.* **2018**, *57*, 10373.
2. *J. Am. Chem. Soc.* **2019**, *141*, 8110.
3. *Angew. Chem. Int. Ed.* **2019**, *58*, 14653.
4. *Angew. Chem. Int. Ed.* **2020**, *59*, 2769.

15-8436 NEW

[S(R)]-N-[(S)-[3,5-Bis(1,1-dimethylethyl)-4-methoxyphenyl][2-(dicyclohexylphosphino)phenyl]methyl]-N,2-dimethyl-2-propanesulfinamide, 95% 50mg

$C_{39}H_{62}NO_2PS$; FW: 640.0; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

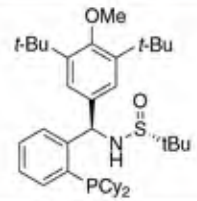
Technical Note:

1. See 15-8438 (page 48)

15-8434 NEW

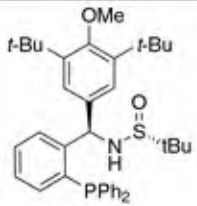
[S(R)]-N-[(R)-[3,5-Bis(1,1-dimethylethyl)-4-methoxyphenyl][2-(dicyclohexylphosphino) phenyl]methyl]-2-methyl-2-propanesulfinamide, 95% 50mg

$C_{38}H_{60}NO_2PS$; FW: 625.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



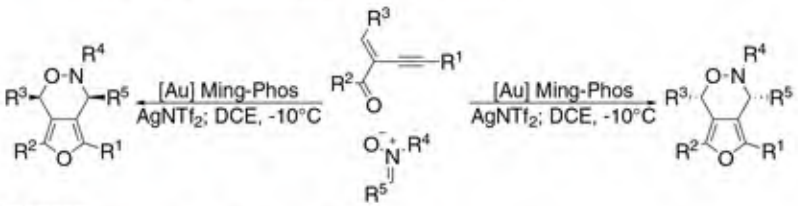
15-8320 NEW

[S(R)]-N-[(R)-[3,5-Bis(1,1-dimethylethyl)-4-methoxyphenyl][2-(diphenylphosphino)phenyl] methyl]-2-methyl-2-propanesulfinamide, 95% 50mg
(1616688-64-2)
$C_{38}H_{48}NO_2PS$; FW: 613.80; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



Technical Note"

1. Ligand for the enantioselective Au-catalyzed [3+3] cycloaddition reaction of 2-(1-alkynyl)-alk-2-en-1-ones with nitrones.



Tech. Note (1)
Ref. (1)

References:

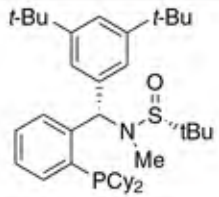
1. *Angew. Chem. Int. Ed.* **2014**, *53*, 4350.

PHOSPHORUS (Compounds)

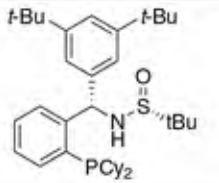
15-8318 NEW
[S(R)]-N-[(S)-[3,5-Bis(1,1-dimethylethyl)-4-methoxyphenyl][2-(diphenylphosphino)phenyl]methyl]-2-methyl-2-propanesulfinamide, 95% 50mg
(1616688-63-1)
$C_{38}H_{48}NO_2PS$; FW: 613.80; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

Technical Note:
1. See 15-8320 (page 49)

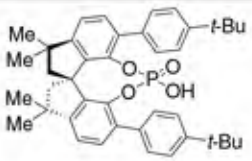
15-8464 NEW
[S(R)]-N-[(S)-3,5-Bis(dimethylethyl)phenyl][2-(dicyclohexylphosphanyl)phenyl]-N,2-dimethyl-2-propanesulfinamide, 95% 50mg
$C_{38}H_{60}NOPS$; FW: 607.9; light-yellow to yellow pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



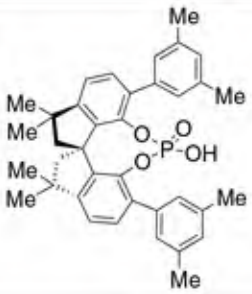
15-8462 NEW
[S(R)]-N-[(S)-3,5-Bis(dimethylethyl)phenyl][2-(dicyclohexylphosphanyl)phenyl]-2-methyl-2-propanesulfinamide, 95% 50mg
$C_{37}H_{58}NOPS$; FW: 595.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



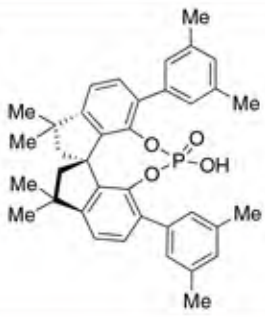
15-8578 NEW
(11aR)-3,7-Bis((4-(1,1-dimethylethyl)phenyl)-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee) 25mg 100mg
$C_{41}H_{47}O_4P$; FW: 634.8; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



15-8562 NEW
(11aR)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee) 25mg 100mg
$C_{37}H_{39}O_4P$; FW: 578.7; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



15-8563 NEW
(11aS)-3,7-Bis(3,5-dimethylphenyl)-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee) 25mg 100mg
$C_{37}H_{39}O_4P$; FW: 578.7; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

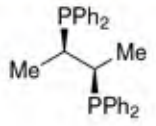


PHOSPHORUS (Compounds)

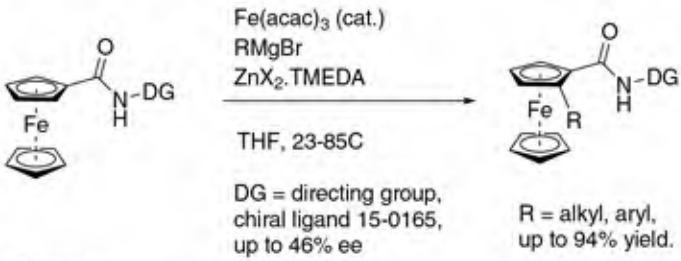
15-0165 NEW

(2R,3R)-(+)-Bis(diphenylphosphino)butane, min.98%,(R,R)-CHIRAPHOS *(74839-84-2)*
$(C_6H_5)_2PCH(CH_3)CH(CH_3)P(C_6H_5)_2$; FW: 426.48; white xtl.; m.p. 104-109 °C
air sensitive

250mg
1g
5g



Technical Notes:
1. A bidentate chiral phosphine ligand used in chiral catalysis.[1-2]
2. Also used in metal catalysis chemistry.[3]



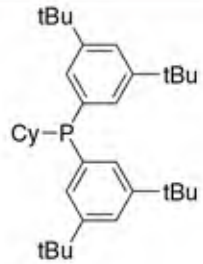
Tech. Note (1)
Ref. (1)

References:
1. *Organometallics*, **2017**, 4979-4989.
2. *J. Am. Chem. Soc.* **1996**, *118*, 4723-4724.
3. *J. Am. Chem. Soc.* **2008**, *130*, 12874-12875.

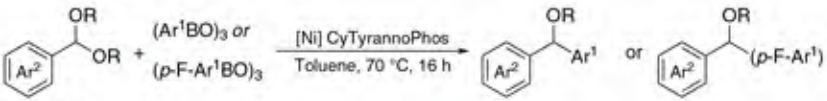
15-8250 NEW amp

Bis(3,5-di-tert-butylphenyl)cyclohexylphosphine, min. 98% CyTyrannoPhos *(2097604-67-4)*
$C_{34}H_{53}P$; FW: 492.76; white to off-white solid
air sensitive, moisture sensitive

250mg
1g



Technical Note:
1. Ligand used for Ni-catalysed Suzuki coupling of reactions of benzylic acetals.



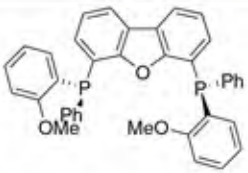
Tech. Note (1)
Ref. (1)

References:
1. Nat. Chem., **2017**, *9*, 779.

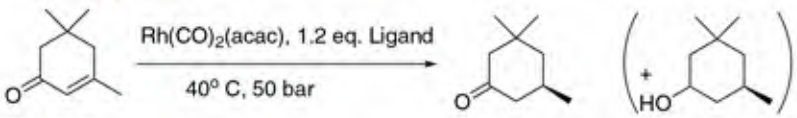
15-1269 NEW

(-)-4,6-Bis((S)-(2-methoxyphenyl)(phenyl) phosphinyl)dibenzo[b,d]furan, min. 97% *(2119686-75-6)*
$C_{38}H_{30}O_3P_2$; FW: 596.60; white to off-white solid
air sensitive, moisture sensitive, (store cold)
Note: Sold under license of WO2017/191310 for research purposes only.

25mg
100mg



Technical Note:
1. P-Chirogenic Xantphos ligand used for the synthesis and application in Rhodium-catalyzed asymmetric hydrogenation.



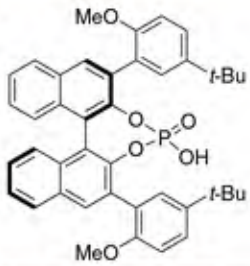
Tech. Note (1)
Ref. (1)

References:
1. *ACS Catal.*, **2017**, 7, 6162−6169.

PHOSPHORUS (Compounds)

15-8524 NEW

(11bR)-2,6-Bis[2-methoxyphenyl-5-(tert-butyl)]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)
$C_{42}H_{41}O_6P$; FW: 672.7; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

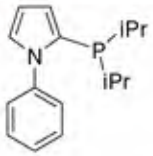
15-8525 NEW

(11bS)-2,6-Bis[2-methoxyphenyl-5-(tert-butyl)]-4-hydroxy-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)
$C_{42}H_{41}O_6P$; FW: 672.7; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-3365 NEW

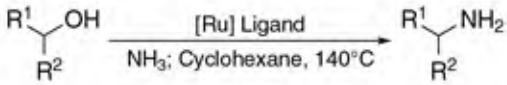
2-[Bis(1-methylethyl)phosphino]-1-phenyl-1H-pyrrole, min. 95% *(1257847-61-2)*
$C_{16}H_{22}NP$; FW: 259.33; white to off-white to pale yellow solid
air sensitive
Note: Sold in collaboration with Solvias for research purposes only. Patents: EP 1625133, US 2007/0123707.



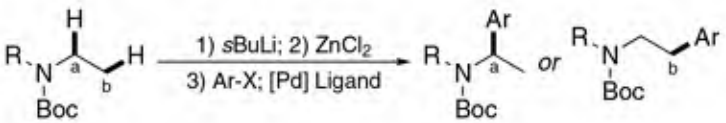
100mg
500mg

Technical Notes:

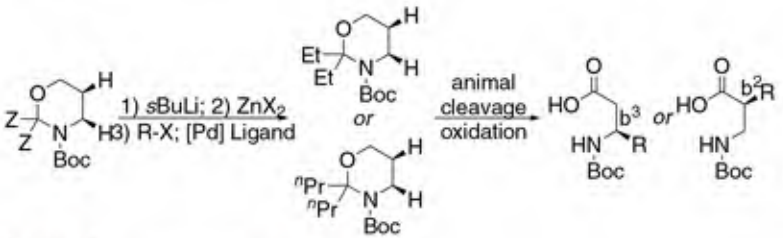
1. Ligand for the Ru-catalyzed direct amination of secondary alcohols using ammonia.
2. Ligand for the Pd-catalyzed α- and β-arylation of acyclic N-Boc amines.
3. Used in Pd-catalyzed enantioselective synthesis of β^2- and β^3- amino acids via asymmetric and regiodivergent C–H Functionalization of Boc-1,3-oxazinanes.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

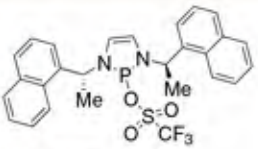
References:

1. *Angew. Chem. Int. Ed.* **2010**, *49*, 8130.
2. *Angew. Chem. Int. Ed.* **2014**, *53*, 2678.
3. *Nat. Catal.* **2019**, *2*, 882.

PHOSPHORUS (Compounds)

15-1285 NEW

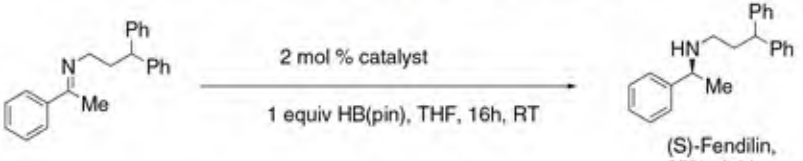
1,3-Bis[(1R)-1-(1-naphthalenyl)ethyl]-2,3-dihydro-1H-1,3,2-diazaphosphol-2-yl trifluoromethanesulfonate, min. 98% *(2377935-66-3)*
$C_{27}F_3H_{24}N_2O_3PS$; FW: 544.53; light beige solid
moisture sensitive
Note: Patents: PCT #CA2018/051078



50mg
250mg

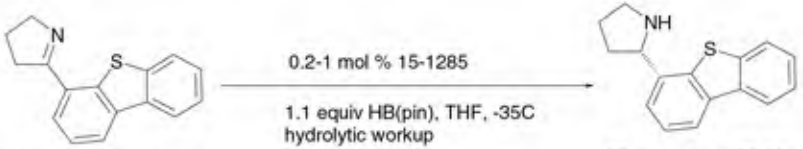
Technical Notes:

1. Asymmetric Imine Hydroboration Catalyzed by Chiral Diazaphospholenes.
2. Enantioselective Imine Reduction Catalyzed by Phosphenium Ions.



(S)-Fendilin,
95% yield,
86:14 e.r.

Tech. Note (1)
Ref. (1)



Phosphenium-catalyzed
asymmetric imine reduction

Borane or silane reductants,
grams of catalyst in 3 steps!

17 examples > 90:10e.r.
> 98% conversion

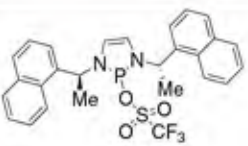
Tech. Note (2)
Ref. (2)

References:

1. *Angew. Chem. Int. Ed.* **2017**, *56*, 16660.
2. *J. Am. Chem. Soc.* **2019**, *141*, 36, 14083-14088.

15-1292 NEW

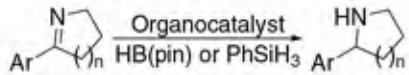
1,3-Bis[(1S)-1-(1-naphthalenyl)ethyl]-2,3-dihydro-1H-1,3,2-diazaphosphol-2-yl trifluoromethanesulfonate, min. 98%
$C_{27}F_3H_{24}N_2O_3PS$; FW: 544.53; light beige solid
air sensitive, moisture sensitive
Note: Patents: PCT #CA2018/051078



50mg
250mg

Technical Note:

1. Used as an organocatalyst for enantioselective imine reduction.



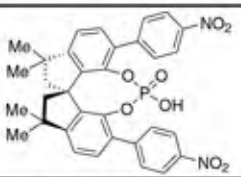
Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.* **2019**, *141*, 14083.

15-8585 NEW

(11aS)-3,7-Bis(4-nitrophenyl)-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 95%, (99% ee)
$C_{33}H_{28}N_2O_8P$; FW: 612.6; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

15-8584 NEW

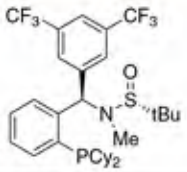
(11aR)-3,7-Bis(4-nitrophenyl)-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)
$C_{33}H_{28}N_2O_8P$; FW: 612.6; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

PHOSPHORUS (Compounds)

15-8460 NEW

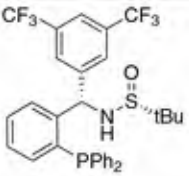
[S(R)]-N-[(R)-3,5-Bis(trifluoromethyl)phenyl][2-(dicyclohexylphosphanyl)phenyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{32}H_{42}F_6NOPS$; FW: 633.7; gray pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

15-8516 NEW

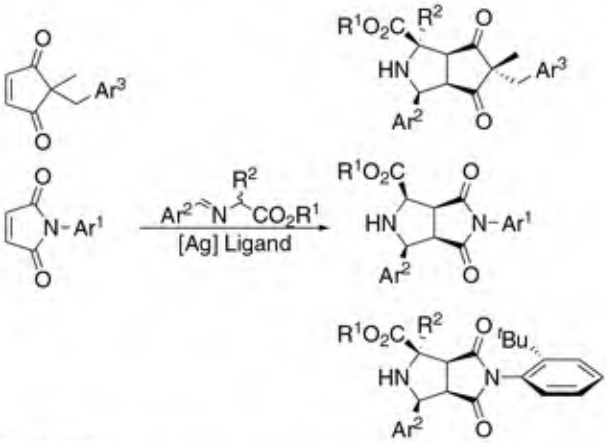
[S(R)]-N-[(S)-[3,5-Bis(trifluoromethyl)phenyl][2- (diphenylphosphino)phenyl]methyl]-2-methyl-2-propanesulfinamide, 95%
(2262535-73-7)
$C_{31}H_{28}F_6NOPS$; FW: 607.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

Technical Note:

1. Phosphine ligand for the Ag(I)-catalyzed enantioselective [3+2] cycloaddition of azomethine ylides.



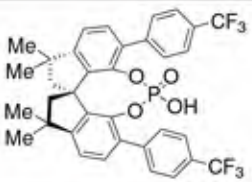
Tech. Note (1)
Ref. (1)

References:

1. *Org. Biomol. Chem.*, **2019**, *17*, 1395.

15-8581 NEW

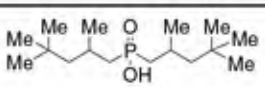
(11aS)-3,7-Bis(4-(trifluoromethyl)phenyl)-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 95%, (99% ee)
$C_{36}H_{29}F_6O_4P$; FW: 658.6; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

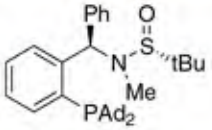
15-7555 NEW

Bis(2,4,4-trimethylpentyl)phosphinic acid, min. 85%, CYTOP® 501 *(83411-71-6)*
$C_{16}H_{35}O_2P$; FW: 290.42; Yellow liq.; f.p. >2226 °F; d. 0.92
Note: Sold in collaboration with Solvay.



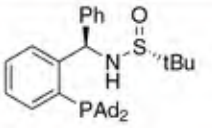
100g
500g

PHOSPHORUS (Compounds)

15-8486 NEW
[S(R)]-N-[(R)-[2-(Diadamantanphosphino) phenyl]phenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{38}H_{52}NOPS$; FW: 601.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.


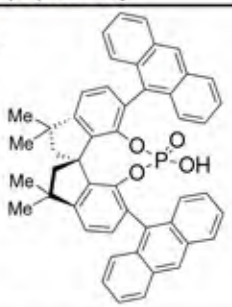
50mg

15-8484 NEW
[S(R)]-N-[(S)-[2-(Diadamantanphosphino)phenyl]phenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{38}H_{52}NOPS$; FW: 601.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.
50mg

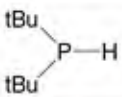
15-8488 NEW
[S(R)]-N-[(R)-[2-(Diadamantanphosphino) phenyl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{37}H_{50}NOPS$; FW: 587.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.


50mg

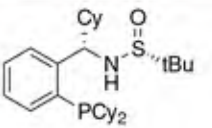
15-8490 NEW
[S(R)]-N-[(S)-[2-(Diadamantanphosphino)phenyl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{37}H_{50}NOPS$; FW: 587.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.
50mg

15-8570 NEW
(11aS)-3,7-Di-9-anthracenyl-10,11,12,13-tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 95%, (99% ee)
$C_{49}H_{39}O_4P$; FW: 722.8;
off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.


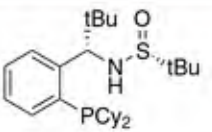
25mg
100mg

15-1044 NEW
Di-t-butylphosphine (50% in Toluene) *(819-19-2)*
$[(CH_3)_3C]_2PH$; FW: 146.22; colorless liq.; d. 0.79
air sensitive


25g
100g

15-8454 NEW
[S(R)]-N-[(1S)-1-[2-(Dicyclohexylphosphanyl) phenyl]-cyclohexyl]-2-methyl-2-propanesulfinamide, 95%
$C_{29}H_{48}NOPS$; FW: 489.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.


50mg

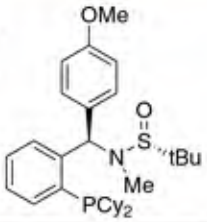
15-8452 NEW
[S(R)]-N-[(1S)-1-[2-(Dicyclohexylphosphanyl) phenyl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95%
$C_{27}H_{46}NOPS$; FW: 463.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.


50mg

PHOSPHORUS (Compounds)

15-8450 NEW — 50mg

[S(R)]-N-[(R)-[2-(Dicyclohexylphosphanyl) phenyl](4-methoxyphenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{31}H_{46}NO_2PS$; FW: 511.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

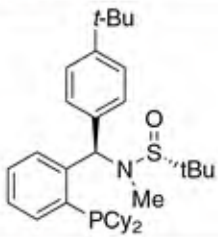


15-8448 NEW — 50mg

[S(R)]-N-[(S)-[2-(Dicyclohexylphosphanyl)phenyl](4-methoxyphenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{31}H_{46}NO_2PS$; FW: 511.7; yellow
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

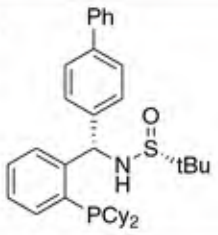
15-8458 NEW — 50mg

[S(R)]-N-[(R)-[2-(Dicyclohexylphosphanyl) phenyl](4-(tert-butyl)phenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{34}H_{52}NOPS$; FW: 553.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



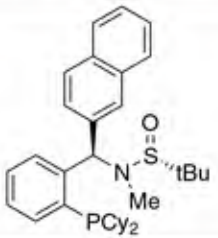
15-8432 NEW — 50mg

[S(R)]-N-[(S)-1-[2-(Dicyclohexylphosphino) phenyl]-(1,1'-biphenyl)methyl]-2-methyl-2-propanesulfinamide, 95%
$C_{39}H_{46}NOPS$; FW: 559.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



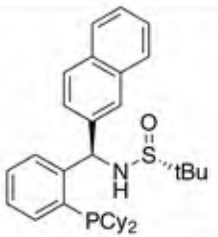
15-8444 NEW — 50mg

[S(R)]-N-[(R)-[2-(Dicyclohexylphosphino) phenyl]-2-naphthalenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{34}H_{46}NOPS$; FW: 547.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8446 NEW — 50mg

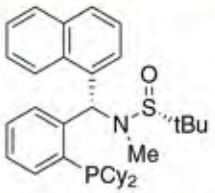
[S(R)]-N-[(R)-[2-(Dicyclohexylphosphino) phenyl]-2-naphthalenylmethyl]-2-dimethyl-2-propanesulfinamide, 95%
$C_{33}H_{44}NOPS$; FW: 533.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



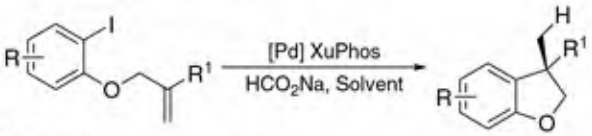
PHOSPHORUS (Compounds)

15-8440 NEW — **[S(R)]-N-[(S)-[2-(Dicyclohexylphosphino) phenyl]-1-naphthalenylmethyl]-N,2-dimeth-yl-2-propanesulfinamide, 95%** *(2241598-33-2)* — 50mg

$C_{34}H_{46}NOPS$; FW: 547.8; pink pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



Technical Note:
1. Ligand for the Pd-catalyzed enantioselective reductive Heck reactions to generate 3,3-disubstituted 2,3-dihydrobenzofuran.



Tech. Note (1)
Ref. (1)

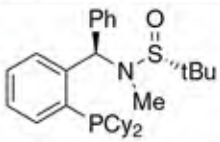
References:
1. *Angew. Chem. Int. Ed.* **2018**, *57*, 10373.

15-8442 NEW — **[S(R)]-N-[(S)-[2-(Dicyclohexylphosphino)phenyl]-2-naphthalenylmeth-yl]-N,2-dimethyl-2-propanesulfinamide, 95%** — 50mg

$C_{34}H_{46}NOPS$; FW: 547.8; light-yellow to yellow pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

15-8430 — **[S(R)]-N-[(R)-[2-(Dicyclohexylphosphino) phenyl]phenylmethyl]-N,2-dimethyl-2-pro-panesulfinamide, 95%** — 50mg

$C_{30}H_{44}NOPS$; FW: 497.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8428 NEW — **[S(R)]-N-[(S)-[2-(Dicyclohexylphosphino)phenyl]phenylmethyl]-N,2-dimeth-yl-2-propanesulfinamide, 95%** *(2241598-32-1)* — 50mg

$C_{30}H_{44}NOPS$; FW: 497.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

Technical Note:
1. See 15-8440 (page 57)

15-8424 NEW — **[S(R)]-N-[(S)-[2-(Dicyclohexylphosphino)phenyl]phenylmethyl]-2-meth-yl-2-propanesulfinamide, 95%** *(1595319-99-5)* — 50mg

$C_{29}H_{42}NOPS$; FW: 483.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

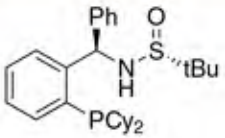
Technical Note:
1. See 15-8426 (page 58)

PHOSPHORUS (Compounds)

15-8426 NEW

[S(R)]-N-[(R)-[2-(Dicyclohexylphosphino)phenyl] phenylmethyl]-2-methyl-2-propanesulfinamide, 95%

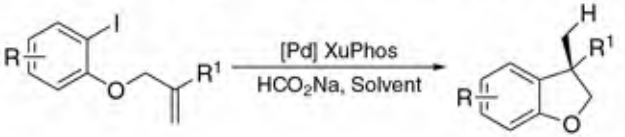
$C_{29}H_{42}NOPS$; FW: 483.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



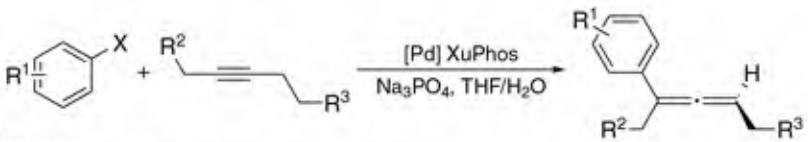
50mg

Technical Notes:

1. Ligand for the Pd-catalyzed enantioselective reductive Heck reactions to generate 3,3-disubstituted 2,3-dihydrobenzofuran.
2. Ligand for the Pd-catalyzed enantioselective Heck reaction of aryl triflates and alkynes.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

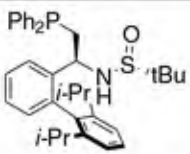
References:

1. *Angew. Chem. Int. Ed.* **2018**, *57*, 10373.
2. *J. Am. Chem. Soc.* **2019**, *141*, 19246.

15-8382 NEW

[S(R)]-N-[(1S)-1-(2',6'-Diisopropyl)-(1,1'-biphenyl)-2-yl]-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{36}H_{44}NOPS$; FW: 569.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

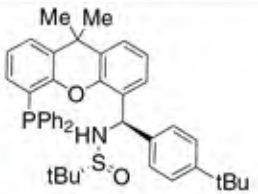


50mg

15-8410 NEW

[S(R)]-N-[(R)-[4-(1,1-Dimethylethyl)phenyl] [5-(diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]methyl]-2-methyl-2-propanesulfinamide, 95% *(2160535-58-8)*

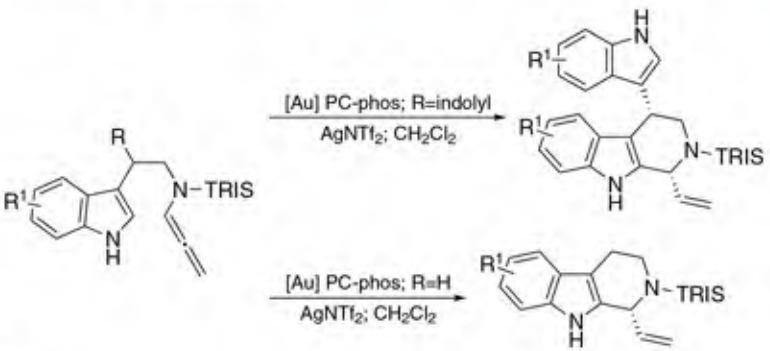
$C_{42}H_{46}NO_2PS$; FW: 659.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

Technical Note:

1. Ligand for the Au-catalyzed asymmetric intramolecular cyclization of N-allenamides for the synthesis of chiral tetrahydrocarbolines.



Tech. Note (1)
Ref. (1)

PHOSPHORUS (Compounds)

15-8410 ***(continued)*** **[S(R)]-N-[(R)-[4-(1,1-Dimethylethyl)phenyl][5-(diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]methyl]-2-methyl-2-propanesulfinamide, 95%** *(2160535-58-8)*

References:

1. *Angew. Chem. Int. Ed.* **2017**, *56*, 15905.

15-8408 NEW **[S(R)]-N-[(S)-[4-(1,1-Dimethylethyl)phenyl][5-(diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]methyl]-2-methyl-2-propanesulfinamide, 95%** 50mg

(2160535-59-9)

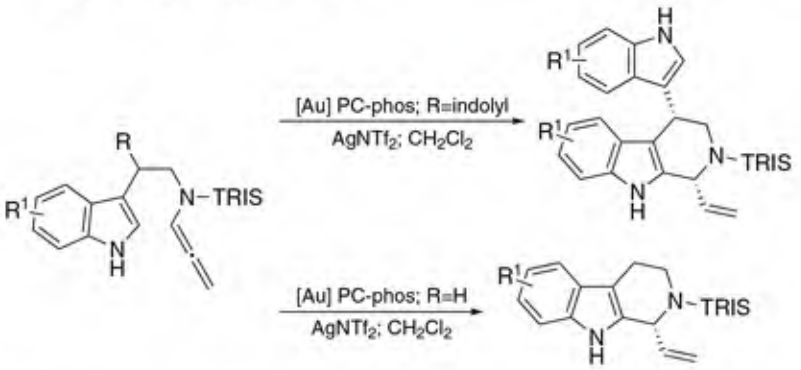
$C_{42}H_{46}NO_2PS$; FW: 659.9; white to off-white pwdr.

air sensitive, moisture sensitive

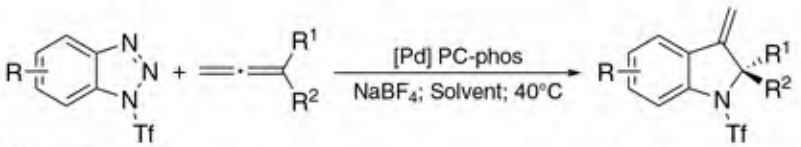
Note: Sold in collaboration with Daicel for research purposes only.

Technical Notes:

1. Ligand for the Au-catalyzed asymmetric intramolecular cyclization of N-allenamides for the synthesis of chiral tetrahydrocarbolines.
2. Ligand for the Pd-catalyzed enantioselective intermolecular denitrogenative cyclization of benzotriazoles with allenes and N-allenamides.



Tech. Note (1)
Ref. (1)

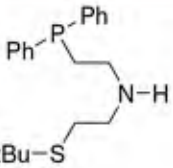


Tech. Note (2)
Ref. (2)

References:

1. *Angew. Chem. Int. Ed.* **2017**, *56*, 15905.
2. *Angew. Chem. Int. Ed.* **2019**, *58*, 11444.

15-4665 NEW **2-[(1,1-Dimethylethyl)thio]-N-[2-(diphenylphosphino)ethyl]-ethanamine** *(1883429-96-6)* 50mg



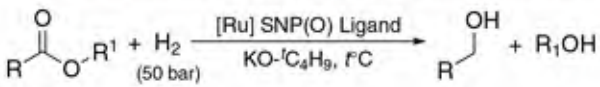
$C_{20}H_{28}NPS$; FW: 345.48; yellow oil

air sensitive

Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.

Technical Note:

1. SNP ligand used in Ru-catalyzed selective ester hydrogenation.



Tech. Note (1)
Ref. (1)

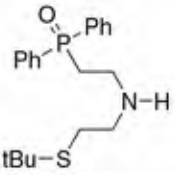
References:

1. *Org. Process Res. Dev.* **2020**, *24*, 415.

PHOSPHORUS (Compounds)

15-4670 NEW

2-[(1,1-Dimethylethyl)thio]-N-[2-(diphenylphosphinyl)ethyl]-ethanamine
$C_{20}H_{28}NOPS$; FW: 361.48; yellow oil
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.

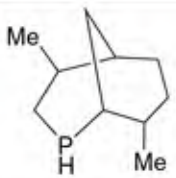


250mg

Technical Note:
1. See 15-4665 (page 59)

15-7605 NEW

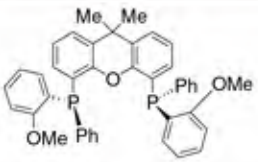
4,8-Dimethyl-2-phosphabicyclo[3.3.1]nonane, min. 90%, CYTOP® 170 *(328952-85-8)*
$C_{10}H_{19}P$; FW: 170.2; Colorless to pale yellow liq.; m.p. -22 °C; b.p. 120 °C; f.p. 221 °F; d. 0.95
air sensitive, moisture sensitive
Note: Sold in collaboration with Solvay.



25g
100g
500g

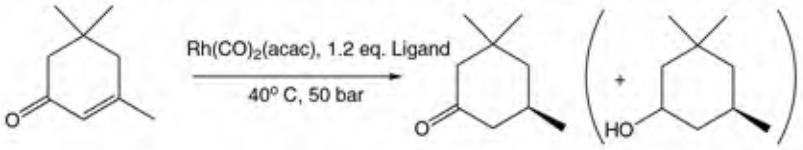
15-1239 NEW

(9,9-Dimethyl-9H-xanthene-4,5-diyl)bis[(o-methoxyphenyl)phenylphosphine], min. 97% *(2119686-35-8)*
$C_{41}H_{36}O_3P_2$; FW: 638.67; white to off-white solid
air sensitive, moisture sensitive, (store cold)
Note: Sold under license of WO2017/191310 for research purposes only.

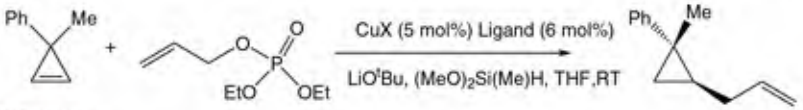


25mg
100mg

Technical Notes:
1. P-Chirogenic Xantphos ligand used for the synthesis and application in Rhodium-catalyzed asymmetric hydrogenation.
2. Diastereo- and enantioselective copper catalyzed hydroallylation of disubstituted cyclopropenes.



Tech. Note (1)
Ref. (1)

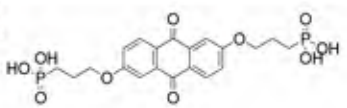


Tech. Note (2)
Ref. (2)

References:
1. *ACS Catal.*, **2017**, *7*, 6162−6169
2. *Chem. Sci.*, **2018**, *9*, 6503-6508.

15-8245 NEW

(((9,10-Dioxo-9,10-dihydroanthracene-2,6-diyl) bis(oxy))bis(propane-3,1-diyl))bis(phosphonic acid), 98%, 2,6-DPPEAQ
$C_{20}H_{22}O_{10}P_2$; FW: 484.33; light yellow to beige pwdr.
Note: U.S. Patents: 62/628,599, 62/740,526. Patent Application: PCT/US19/17479. Product sold under, use subject to, terms and conditions of Limited Use License at www.strem.com/harvard5



1g
5g

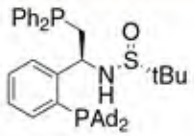
Technical Note:
1. A highly stable phosphonate-functionalized anthraquinone used as a redox-active material in a negative potential electrolyte (negolyte) for aqueous redox flow batteries operating at nearly neutral pH.

References:
1. *Adv. Energy Mater.* **2019**, *9(12)*, 1900039.
2. *Joule*, **2018**, *2(9)*, 1894–1906.

PHOSPHORUS (Compounds)

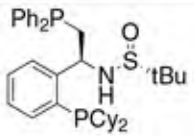
15-8396 NEW — 50mg

[S(R)]-N-[(1S)-2-(Diphenylphosphino)-1-[2-(di-adamantanphosphanyl)phenyl]ethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{44}H_{67}NOP_2S$; FW: 709.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



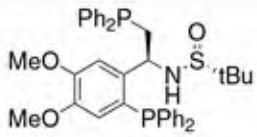
15-8394 NEW — 50mg

[S(R)]-N-[(1S)-2-(Diphenylphosphino)-1-[2-(dicyclohexylphosphanyl)phenyl]ethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{36}H_{49}NOP_2S$; FW: 605.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



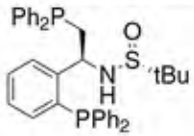
15-8398 NEW — 50mg

[S(R)]-N-[(1S)-2-(Diphenylphosphino)-1-[2-(diphenylphosphino)-4,5-dimethoxyphenyl]ethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{38}H_{41}NO_3P_2S$; FW: 653.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



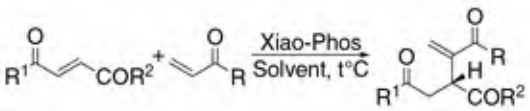
15-8392 NEW — 50mg

[S(R)]-N-[(1S)-2-(Diphenylphosphino)-1-[2-(diphenylphosphino)phenyl]ethyl]-2-methyl-2-propanesulfinamide, 95% *(1824731-39-6)*
$C_{36}H_{37}NOP_2S$; FW: 593.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

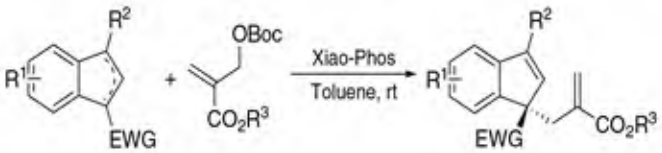


Technical Notes:

1. Chiral sulfinamide bisphosphine catalysts for highly enantioselective intermolecular cross-Rauhut-Currier reactions.
2. Used in phosphine-catalyzed asymmetric intermolecular cross-vinylogous Rauhut-Currier Reactions of vinyl Ketones with para-quinone methides.
3. Used in the enantioselective phosphine-catalyzed allylic alkylations of mix-indene with MBH carbonates.
4. Ligand for the Pd-catalyzed fast and living polymerizations of various diazoacetate monomers under mild conditions.
5. Ligand for the direct Pd-catalyzed cross-coupling reaction of easily accessible secondary phosphine oxides and aryl bromides, which provides rapid access to P-chiral phosphine oxides.



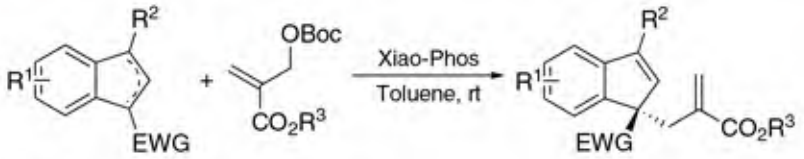
Tech. Note (1)
Ref. (1)



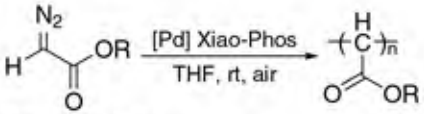
Tech. Note (2)
Ref. (2)

PHOSPHORUS (Compounds)

15-8392 *(continued)* **[S(R)]-N-[(1S)-2-(Diphenylphosphino)-1-[2-(diphenylphosphino)phenyl]ethyl]-2-methyl-2-propanesulfinamide, 95%** *(1824731-39-6)*

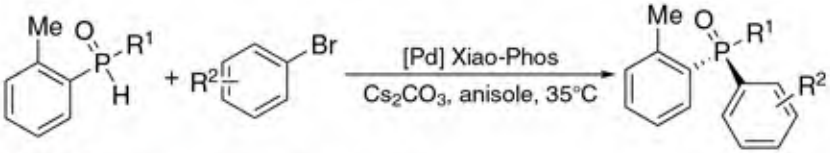


Tech. Note (3)
Ref. (3)



R = Alkyl or Aryl

Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)

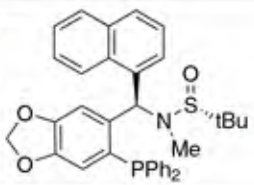
References:

1. *Angew. Chem. Int. Ed.* **2015,** *54*, 14853.
2. *ACS Catal.* **2017**, *7*, 2805.
3. *Org. Lett.* **2017,** *19*, 6080.
4. *J. Am. Chem. Soc.* **2018**, *140*, 17773.
5. *J. Am. Chem. Soc.* **2019**, *141*, 20556.

15-8358 NEW — 50mg

[S(R)]-N-[(R)-[6-(Diphenylphosphino)benzo[d][1,3]dioxol-5-yl]-1-naphthalenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%

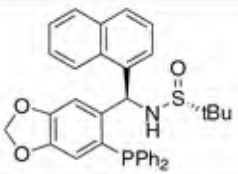
$C_{35}H_{34}NO_3PS$; FW: 579.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8354 NEW — 50mg

[S(R)]-N-[(R)-[6-(Diphenylphosphino)benzo[d][1,3]dioxol-5-yl]-1-naphthalenylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{34}H_{32}NO_3PS$; FW: 565.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8356 NEW — 50mg

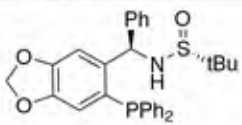
[S(R)]-N-[(S)-[6-(Diphenylphosphino)benzo[d][1,3]dioxol-5-yl]-1-naphthalenylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{34}H_{32}NO_3PS$; FW: 565.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

15-8352 NEW — 50mg

[S(R)]-N-[(R)-[6-(Diphenylphosphino)benzo[d][1,3]dioxol-5-yl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{30}H_{30}NO_3PS$; FW: 515.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

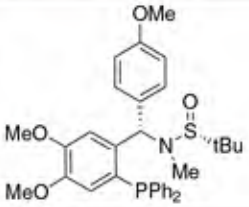


PHOSPHORUS (Compounds)

15-8350 NEW — **[S(R)]-N-[(S)-[6-(Diphenylphosphino)benzo[d][1,3]dioxol-5-yl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%** — 50mg

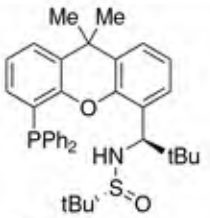
$C_{30}H_{30}NO_3PS$; FW: 515.6; white to off-white pwdr.
air sensitive, light sensitive
Note: Sold in collaboration with Daicel for research purposes only.

15-8360 NEW — **[S(R)]-N-[(S)-[2-(Diphenylphosphino)-4,5-dimethoxyphenyl)](4-methoxyphenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%** — 50mg



$C_{33}H_{38}NO_4PS$; FW: 575.7; light-yellow to yellow pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

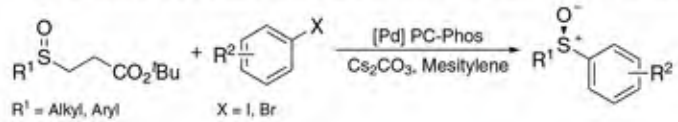
15-8422 NEW — **[S(R)]-N-[(1R)-1-[5-(Diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95%** — 25mg



(2162939-92-4)
$C_{36}H_{42}NO_2PS$; FW: 583.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

Technical Note:

1. Ligand for the Pd-catalyzed enantioselective arylation of general sulfenate anions.



R¹ = Alkyl, Aryl X = I, Br

Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.* **2018**, *140*, 3467.

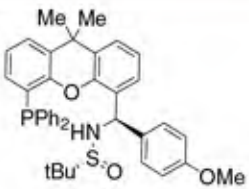
15-8420 NEW — **[S(R)]-N-[(1S)-1-[5-(Diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95%** — 50mg

(2162939-89-9)
$C_{36}H_{42}NO_2PS$; FW: 583.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

Technical Note:

1. See 15-8422 (page 63)

15-8400 — **[S(R)]-N-[(R)-[5-(Diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl](4-methoxyphenyl)methyl]-2-methyl-2-propanesulfinamide, 95%** — 50mg



(2160535-56-6)
$C_{39}H_{40}NO_3PS$; FW: 633.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

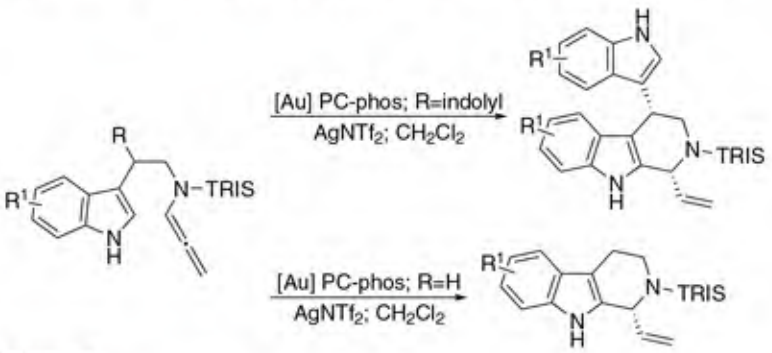
Technical Note:

1. Ligand for the Au-catalyzed asymmetric intramolecular cyclization of N-allenamides for the synthesis of chiral tetrahydrocarbolines.

PHOSPHORUS (Compounds)

15-8400 *(continued)*

[S(R)]-N-[(R)-[5-(Diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl](4-methoxyphenyl) methyl]-2-methyl-2-propanesulfinamide, 95% *(2160535-56-6)*



Tech. Note (1)
Ref. (1)

References:

1. *Angew. Chem. Int. Ed.* **2017**, *56*, 15905.

15-8402 NEW

[S(R)]-N-[(S)-[5-(Diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl](4-methoxyphenyl)methyl]-2-methyl-2-propanesulfinamide, 95% *(2160535-57-7)*

$C_{39}H_{40}NO_3PS$; FW: 633.8; white to off-white pwdr.

air sensitive, moisture sensitive

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

50mg

Technical Note:

1. See 15-8400 (page 63)

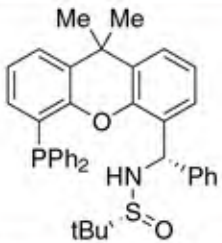
15-8418 NEW

[S(R)]-N-[(S)-(phenyl)[5-(Diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl](phenyl) methyl]-2-methyl-2-propanesulfinamide, 95%

$C_{38}H_{38}NO_2PS$; FW: 603.8; white to off-white pwdr.

air sensitive, moisture sensitive

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



50mg

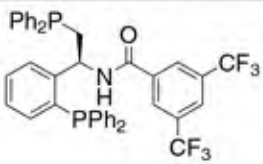
15-8512 NEW

N-[(1S)-2-(Diphenylphosphino)-1-(2-(diphenylphosphino)phenyl)ethyl]-3,5-bis(trifluoromethyl)-benzamide, 95%

$C_{41}H_{31}F_6NOP_2$; FW: 729.6; white to off-white pwdr.

air sensitive, moisture sensitive

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



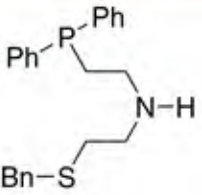
50mg

PHOSPHORUS (Compounds)

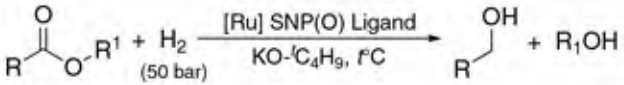
15-4645 NEW

N-[2-(Diphenylphosphino)ethyl]-2-[(4-methylphenyl)thio]-ethanamine *(1883429-99-9)*
$C_{23}H_{26}NPS$; FW: 379.50; yellow oil
air sensitive
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.

100mg



Technical Note:
1. SNP ligand used in Ru-catalyzed selective ester hydrogenation.



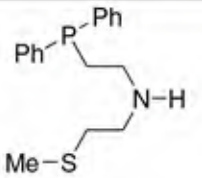
Tech. Note (1)
Ref. (1)

References:
1. *Org. Process Res. Dev.* **2020**, *24*, 415.

15-4625 NEW

N-[2-(Diphenylphosphino)ethyl]-2-(methylthio)-ethanamine *(1802182-42-8)*
$C_{17}H_{22}NPS$; FW: 303.40; yellow oil
air sensitive
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.

50mg

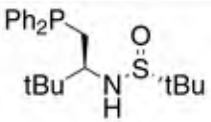


Technical Note:
1. See 15-4645 (page 65)

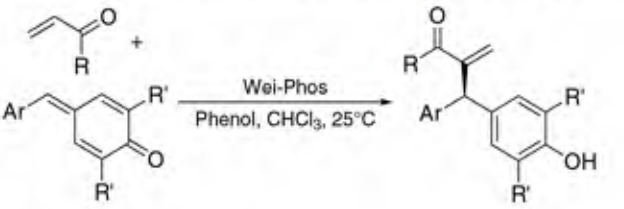
15-8378 NEW

[S(R)]-N-[(1S)-1-[(Diphenylphosphino)methyl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95% *(1853342-54-7)*
$C_{22}H_{32}NOPS$; FW: 389.5; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

100mg



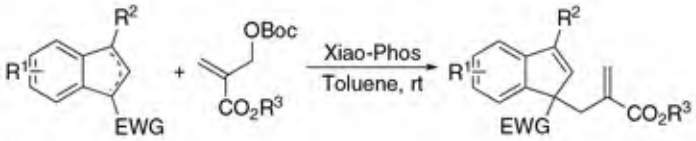
Technical Notes:
1. Used in phosphine-catalyzed asymmetric intermolecular cross-vinylogous Rauhut-Currier Reactions of vinyl Ketones with para-quinone methides.
2. Used in the enantioselective phosphine-catalyzed allylic alkylations of mix-indene with MBH carbonates.



Tech. Note (1)
Ref. (1)

PHOSPHORUS (Compounds)

15-8378 ***(continued)*** **[S(R)]-N-[(1S)-1-[(Diphenylphosphino)methyl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95%** *(1853342-54-7)*



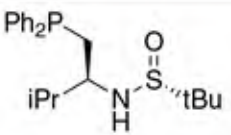
Tech. Note (2)
Ref. (2)

References:

1. *ACS Catal.* **2017**, *7*, 2805.
2. *Org. Lett.* **2017**, *19*, 6080.

15-8376 NEW **[S(R)]-N-[(1S)-1-[(Diphenylphosphino)methyl]-2-methylpropyl]-2-methyl-2-Propanesulfinamide, 95%** *(1803239-46-4)*

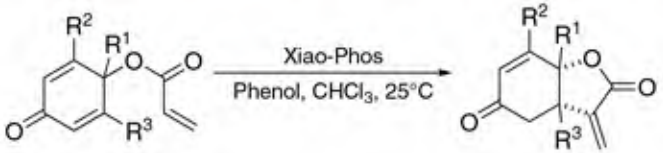
50mg



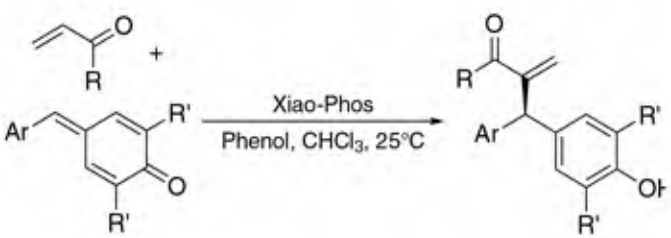
$C_{21}H_{30}NOPS$; FW: 375.5; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

Technical Notes:

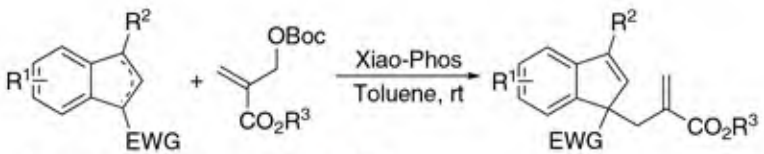
1. Sulfinamide phosphine organocatalyst for the enantioselective intramolecular Rauhut-Currier reaction.
2. Used in phosphine-catalyzed asymmetric intermolecular cross-vinylogous Rauhut-Currier Reactions of vinyl Ketones with para-quinone methides.
3. Used in the enantioselective phosphine-catalyzed allylic alkylations of mix-indene with MBH carbonates.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

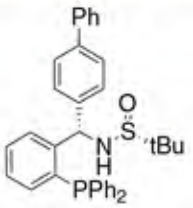
1. *Angew. Chem. Int. Ed.* **2015**, *54*, 6874.
2. *ACS Catal.* **2017**, *7*, 2805.
3. *Org. Lett.* **2017**, *19*, 6080.

PHOSPHORUS (Compounds)

15-8326 NEW

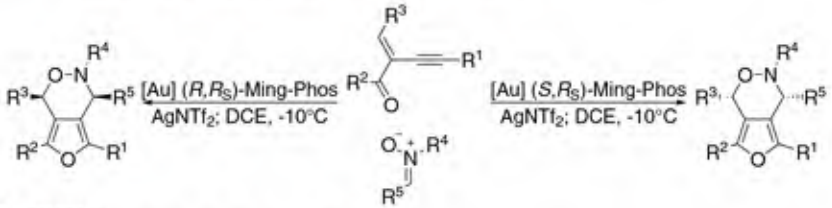
[S(R)]-N-[(S)-[2-(Diphenylphosphino) phenyl]-(1,1'-biphenyl)methyl]-2-methyl-2-propanesulfinamide, 95% 100mg

$C_{35}H_{34}NOPS$; FW: 547.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



Technical Note:

1. Ligand for the enantioselective Au-catalyzed [3+3] cycloaddition reaction of 2-(1-alkynyl)-alk-2-en-1-ones with nitrones.



Tech. Note (1)
Ref. (1)

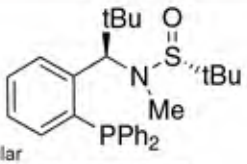
References:

1. *Angew. Chem. Int. Ed.* **2014**, *53*, 4350.

15-8348 NEW

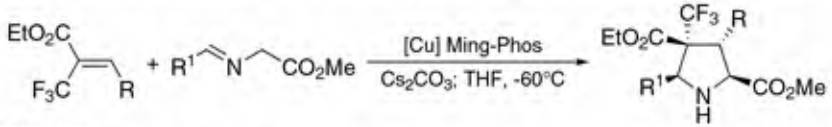
[S(R)]-N-[(1R)-1-[2-(Diphenylphosphino) phenyl]-2,2-dimethylpropyl]-N,2-dimethyl-2-propanesulfinamide, 95% *(2049042-08-0)* 50mg

$C_{28}H_{36}NOPS$; FW: 465.6; white to off-white pwdr.
moisture sensitive



Technical Note:

1. Ligand used in the Copper(I)-catalyzed asymmetric intermolecular [3+2] cycloaddition of azomethine ylides with α Trifluoromethyl α,β-unsaturated esters.



Tech. Note (1)
Ref. (1)

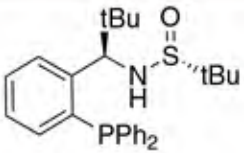
References:

1. *ACS Catal.* **2017**, *7*, 210.

15-8330 NEW

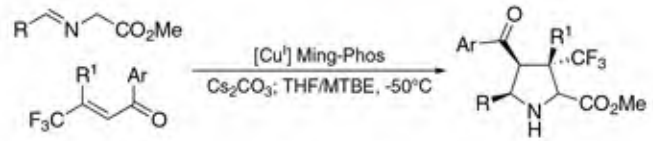
[S(R)]-N-[(1R)-1-[2-(Diphenylphosphino) phenyl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95% *(1906918-20-4)* 50mg

$C_{27}H_{34}NOPS$; FW: 451.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



Technical Notes:

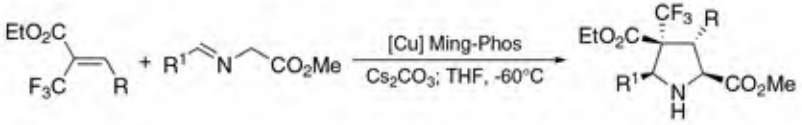
1. Ligand used for diastereo- and enantioselective Cu(I)-catalyzed intermolecular [3+2] cycloaddition of azomethine ylides with β-trifluoromethyl β, β-Disubstituted enones.
2. Ligand used in the Copper(I)-catalyzed asymmetric intermolecular [3+2] cycloaddition of azomethine ylides with α-Trifluoromethyl α,β-unsaturated esters.
3. Ligand used for Ag(I)-catalyzed enantioselective [3+2] cycloaddition of azomethine ylides.



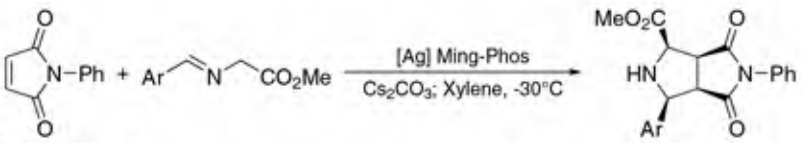
Tech. Note (1)
Ref. (1)

PHOSPHORUS (Compounds)

15-8330 **[S(R)]-N-[(1R)-1-[2-(Diphenylphosphino)phenyl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95%** *(1906918-20-4)*
(continued)



Tech. Note (2)
Ref. (2)



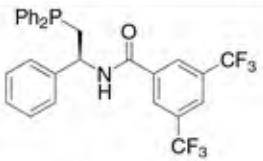
Tech. Note (3)
Ref. (3)

References:

1. *Angew. Chem. Int. Ed.* **2016**, *55*, 6324.
2. *ACS Catal.* **2017**, *7*, 210.
3. *Org. Biomol. Chem.*, **2019**, *17*, 1395.

15-8514 NEW

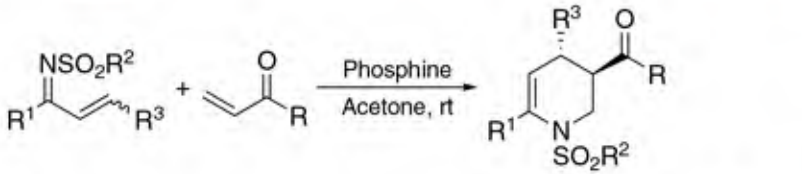
N-[(1S)-2-(Diphenylphosphino)-1-phenylethyl]-3,5-bis(trifluoromethyl)-benzamide, 95% *(1853342-57-0)*
$C_{29}H_{22}F_6NOP$; FW: 545.5; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



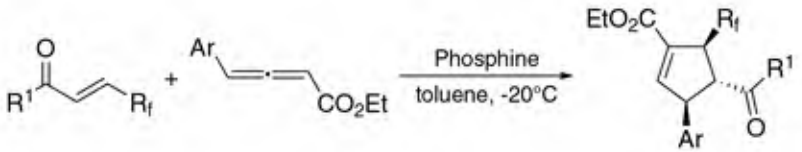
50mg

Technical Notes:

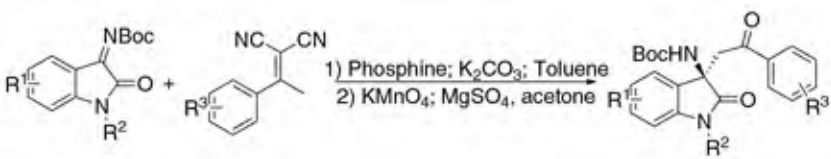
1. Organocatalyst used in aza-[4+2] cycloaddition of N-sulfonyl-1-aza-1,3-dienes with vinyl ketones.
2. Catalyst for the enantioselective [3+2] cycloadditions of γ-substituted allenoates with β-perfluoroalkyl enones.
3. Organocatalyst used in effective asymmetric vinylogous Mannich reaction of isatin imines with α,α-dicyanoolefins.
4. Chiral phosphine catalyzed α-functionalization of 2-vinylpyridines via enantioselective cross Rauhut-Currier reaction.



Tech. Note (1)
Ref. (1)



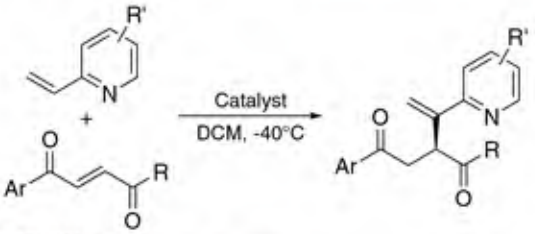
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

PHOSPHORUS (Compounds)

15-8514 **N-[(1S)-2-(Diphenylphosphino)-1-phenylethyl]-3,5-bis(trifluoromethyl)-benzamide, 95%**
(continued) *(1853342-57-0)*



Tech. Note (4)
Ref. (4)

References:

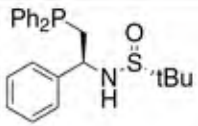
1. *Org. Lett.* **2017**, *19*, 1710.
2. *Chem. Sci.*, **2017**, *8*, 4660.
3. *Org. Chem. Front.*, **2017**, *4*, 101.
4. *Org. Lett.* **2018**, *20*, 1304.

15-8366 100mg

NEW

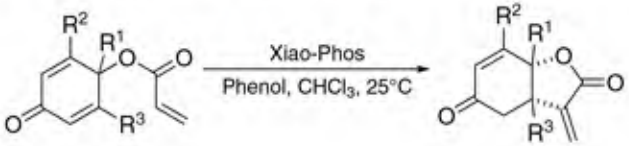
[S(R)]-N-[(1S)-2-(Diphenylphosphino)-1-phenylethyl]-2-methyl-2-propanesulfinamide, 95% *(1803239-44-2)*

$C_{24}H_{28}NOPS$; FW: 409.5; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

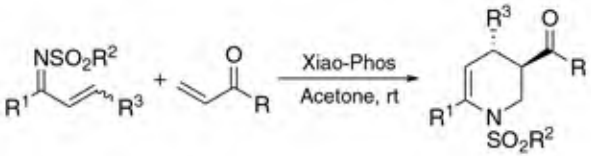


Technical Notes:

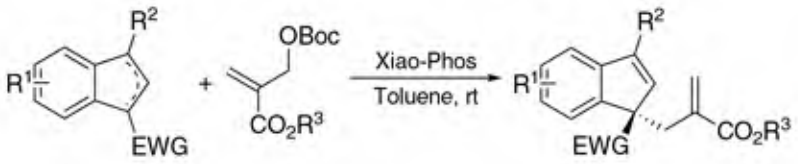
1. Sulfinamide phosphine organocatalyst for the enantioselective intramolecular Rauhut-Currier reaction.
2. Organocatalyst used in aza-[4+2] cycloaddition of N-sulfonyl-1-aza-1,3-dienes with vinyl ketones.
3. Used in the enantioselective phosphine-catalyzed allylic alkylations of mix-indene with MBH carbonates.
4. Ligand for the direct Pd-catalyzed cross-coupling reaction of easily accessible secondary phosphine oxides and aryl bromides, which provides rapid access to P-chiral phosphine oxides.



Tech. Note (1)
Ref. (1)



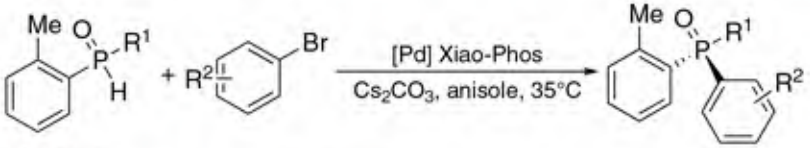
Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

PHOSPHORUS (Compounds)

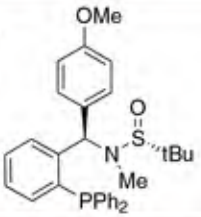
15-8366 **[S(R)]-N-[(1S)-2-(Diphenylphosphino)-1-phenylethyl]-2-methyl-2-propanesulfinamide, 95%**
(continued) *(1803239-44-2)*



Tech. Note (4)
Ref. (4)

References:
1. *Angew. Chem. Int. Ed.* **2015**, *54*, 6874.
2. *Org. Lett.* **2017**, *19*, 1710.
3. *Org. Lett.* **2017**, *19*, 6080.
4. *J. Am. Chem. Soc.* **2019**, *141*, 20556.

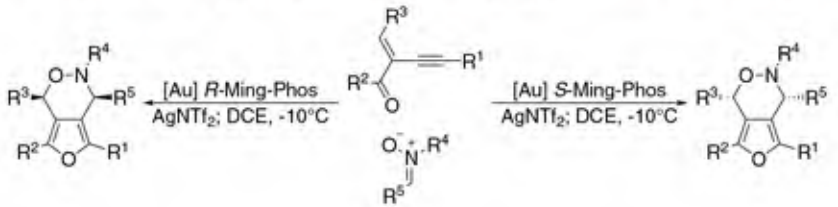
15-8338 NEW **[S(R)]-N-[(R)-[2-(Diphenylphosphino)phenyl](4-methoxyphenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%** 50mg
$C_{31}H_{34}NO_2PS$; FW: 515.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



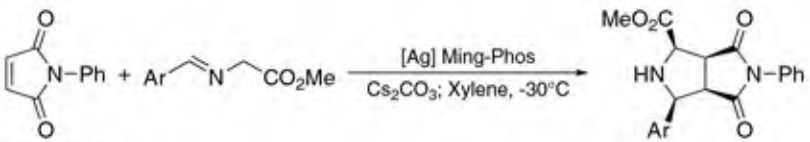
15-8336 NEW **[S(R)]-N-[(S)-[2-(Diphenylphosphino)phenyl](4-methoxyphenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%** 50mg
$C_{31}H_{34}NO_2PS$; FW: 515.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

15-8314 NEW **[S(R)]-N-[(S)-[2-(Diphenylphosphino)phenyl](4-methoxyphenyl)methyl]-2-methyl-2-propanesulfinamide, 95%** *(1616688-62-0)* 100mg
$C_{30}H_{32}NO_2PS$; FW: 501.60; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

Technical Notes:
1. Ligand for the enantioselective Au-catalyzed [3+3] cycloaddition reaction of 2-(1-alkynyl)-alk-2-en-1-ones with nitrones.
2. Ligand used for Ag(I)-catalyzed enantioselective [3+2] cycloaddition of azomethine ylides.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

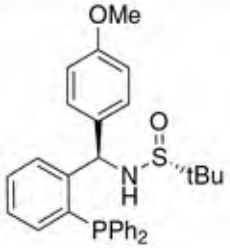
References:
1. *Angew. Chem. Int. Ed.* **2014**, *53*, 4350.
2. *Org. Biomol. Chem.*, **2019**, *17*, 1395.

PHOSPHORUS (Compounds)

15-8316 NEW

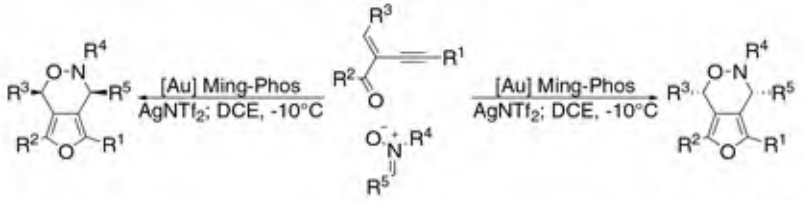
[S(R)]-N-[(R)-[2-(Diphenylphosphino)phenyl](4-methoxyphenyl)methyl]-2-methyl-2-propanesulfinamide, 95% *(1595319-96-2)*
$C_{30}H_{32}NO_2PS$; FW: 501.60; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

100mg

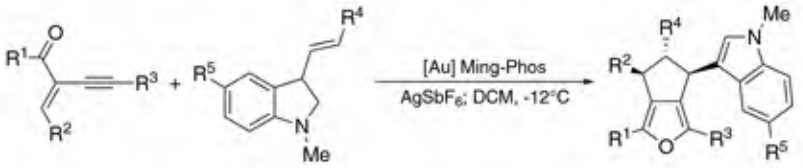


Technical Notes:

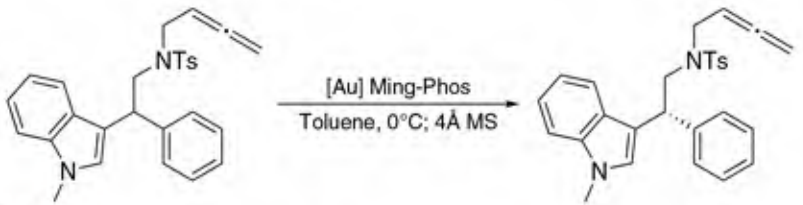
1. Ligand for the enantioselective Au-catalyzed [3+3] cycloaddition reaction of 2-(1-alkynyl)-alk-2-en-1-ones with nitrones.
2. Used in enantioselective Au-catalyzed synthesis of indolyl-substituted cyclopenta[c]furans.
3. Used in the Au-catalyzed enantioselective synthesis of polycyclic indoline skeletons and enantiomerically enriched β-substituted tryptamine-allenes by kinetic resolution.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

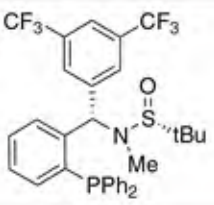
References:

1. *Angew. Chem. Int. Ed.* **2014,** *53*, 4350.
2. *Org. Lett.* **2018**, *20*, 6403.
3. *Chem. Commun.*, **2019,** *55*, 4210.

15-8346 NEW

[S(R)]-N-[(S)-[3,5-Bis(trifluoromethyl)phenyl][2-(diphenylphosphino)phenyl]methyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{32}H_{30}F_6NOPS$; FW: 621.6; light-yellow to yellow pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

50mg

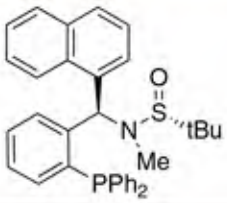


PHOSPHORUS (Compounds)

15-8342 NEW — 50mg

[S(R)]-N-[(R)-[2-(Diphenylphosphino) phenyl]-1-naphthalenylmethyl]-N,2-dimeth-yl-2-propanesulfinamide, 95%

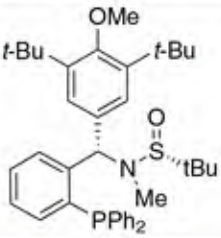
$C_{34}H_{34}NOPS$; FW: 535.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8344 NEW — 50mg

[S(R)]-N-[(S)-[3,5-Bis(1,1-dimethylethyl)-4-me-thoxyphenyl][2-(diphenylphosphino)phenyl] methyl]-N,2-dimethyl-2-propanesulfinamide, 95%

$C_{39}H_{50}NO_2PS$; FW: 535.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8340 NEW — 50mg

[S(R)]-N-[(S)-[2-(Diphenylphosphino)phenyl]-1-naphthalenylmethyl]-N,2-di-methyl-2-propanesulfinamide, 95%

$C_{34}H_{34}NOPS$; FW: 535.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

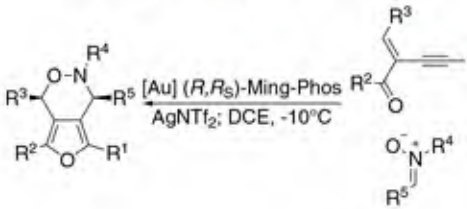
15-8322 NEW — 100mg

[S(R)]-N-[(S)-[2-(Diphenylphosphino)phenyl]-1-naphthalenylmeth-yl]-2-methyl-2-propanesulfinamide, 95% *(1595319-95-1)*

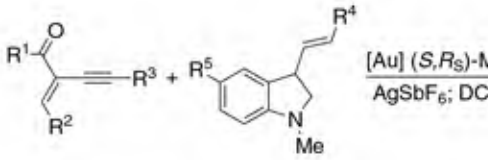
$C_{33}H_{32}NOPS$; FW: 521.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

Technical Notes:

1. Ligand for the enantioselective Au-catalyzed [3+3] cycloaddition reaction of 2-(1-alkynyl)-alk-2-en-1-ones with nitrones.
2. Used in enantioselective Au-catalyzed synthesis of indolyl-substituted cyclopenta[c]furans.
3. Ligand for the enantioselective Au-catalyzed intermolecular exo [4+3]-cycloaddition to generate chiral oxa-bridged benzocycloheptanes.



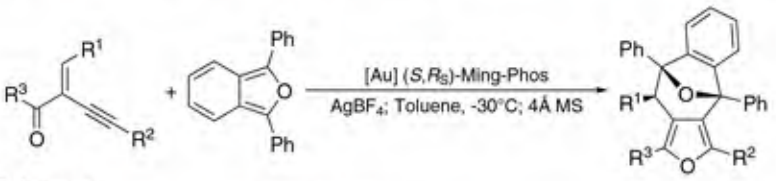
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

PHOSPHORUS (Compounds)

15-8322 ***(continued)*** **[S(R)]-N-[(S)-[2-(Diphenylphosphino)phenyl]-1-naphthalenylmethyl]-2-methyl-2-propanesulfinamide, 95%** *(1595319-95-1)*

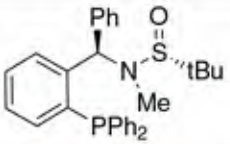


Tech. Note (3)
Ref. (3)

References:
1. *Angew. Chem. Int. Ed.* **2014**, *53*, 4350.
2. *Org. Lett.* **2018**, *20*, 6403.
3. *Org. Lett.* **2019**, *21*, 3018.

15-8334 NEW **[S(R)]-N-[(R)-[2-(Diphenylphosphino)phenyl]phenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%** 50mg

$C_{30}H_{32}NOPS$; FW: 485.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

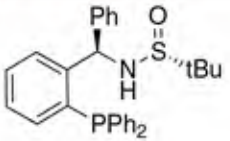


15-8332 NEW **[S(R)]-N-[(S)-[2-(Diphenylphosphino)phenyl]phenylmethyl]-N,2-dimethyl-2-propanesulfinamide, 95%** 50mg

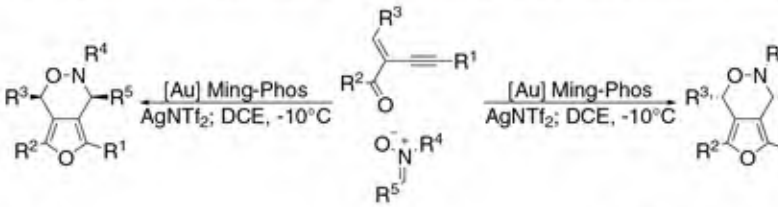
$C_{30}H_{32}NOPS$; FW: 485.6; light-yellow to yellow pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

15-8312 NEW **[S(R)]-N-[(R)-[2-(Diphenylphosphino)phenyl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%** *(1616688-59-5)* 100mg

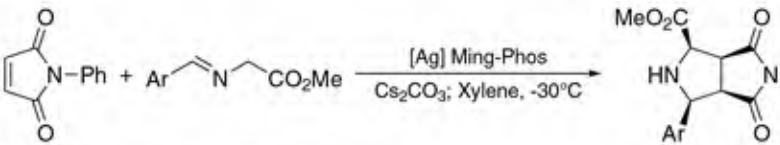
$C_{29}H_{30}NOPS$; FW: 471.60; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



Technical Notes:
1. Ligand for the enantioselective Au-catalyzed [3+3] cycloaddition reaction of 2-(1-alkynyl)-alk-2-en-1-ones with nitrones.
2. Ligand used for Ag(I)-catalyzed enantioselective [3+2] cycloaddition of azomethine ylides.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:
1. *Angew. Chem. Int. Ed.* **2014**, *53*, 4350.
2. *Org. Biomol. Chem.*, **2019**, *17*, 1395.

PHOSPHORUS (Compounds)

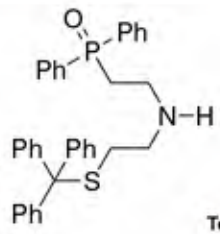
15-8310 NEW — **[S(R)]-N-[(S)-[2-(Diphenylphosphino)phenyl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%** *(1595319-97-3)* — 100mg

$C_{29}H_{30}NOPS$; FW: 471.60; white to off-white pwdr
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

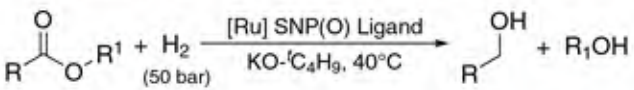
Technical Note:
1. See 15-8312 (page 73)

15-4660 NEW — **N-[2-(Diphenylphosphinyl)ethyl]-2-[tritylthio]-ethanamine** — 250mg

$C_{35}H_{34}NOPS$; FW: 547.70; waxy solid
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.



Technical Note:
1. SNP(O) ligand used in Ru-catalyzed selective ester hydrogenation.

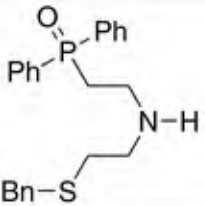


Tech. Note (1)
Ref. (1)

References:
1. *Org. Process Res. Dev.* **2020**, *24*, 415.

15-4640 NEW — **N-[2-(Diphenylphosphinyl)ethyl]-2-[(4-methylphenyl)thio]-ethanamine** — 250mg

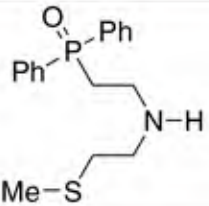
$C_{23}H_{26}NOPS$; FW: 395.50; white solid
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.



Technical Note:
1. See 15-4660 (page 74)

15-4620 NEW — **N-[2-(Diphenylphosphinyl)ethyl]-2-(methylthio)-ethanamine** *(1839552-30-5)* — 250mg

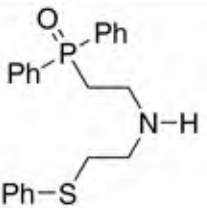
$C_{17}H_{22}NOPS$; FW: 319.4; white solid
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No 62/827,627.



Technical Note:
1. See 15-4660 (page 74)

15-4630 NEW — **N-[2-(Diphenylphosphinyl)ethyl]-2-(phenylthio)-ethanamine** — 100mg

$C_{22}H_{24}NOPS$; FW: 381.47; white solid
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.

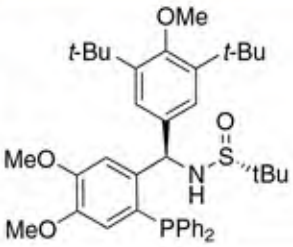


Technical Note:
1. See 15-4660 (page 74)

PHOSPHORUS (Compounds)

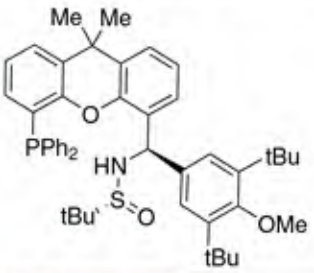
15-8364 NEW — 50mg

[S(R)]-N-[(R)-(3,5-Di-tert-butyl-4-methoxyphenyl)[2-(diphenylphosphino)-4,5-dimethoxyphenyl]-2-methyl-2-propanesulfinamide, 95%
$C_{40}H_{52}NO_4PS$; FW: 673.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8412 NEW — 50mg

[S(R)]-N-[(R)-[3,5-Di-tert-butyl-4-methoxyphenyl][5-(diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]methyl]-2-methyl-2-propanesulfinamide, 95%
$C_{47}H_{56}NO_3PS$; FW: 746.0; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

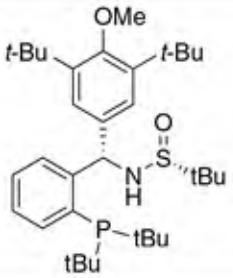


15-8414 NEW — 50mg

[S(R)]-N-[(S)-[3,5-Di-tert-butyl-4-methoxyphenyl][5-(diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]methyl]-2-methyl-2-propanesulfinamide, 95%
$C_{47}H_{56}NO_3PS$; FW: 746.0; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

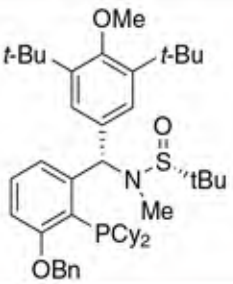
15-8496 NEW — 25mg

[S(R)]-N-[(S)-(3,5-Di-tert-butyl-4-methoxyphenyl)[2-(di-tert-butylphosphino)phenyl]methyl]-2-methyl-2-propanesulfinamide, 95%
$C_{34}H_{56}NO_2PS$; FW: 573.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



15-8468 NEW — 25mg

[S(R)]-N-[(S)-[3,5-Di-tert-butyl-4-methoxyphenyl][(3-benzyloxy-2-(dicyclohexylphosphino)phenyl)methyl]-N,2-dimethyl-2-propanesulfinamide, 95%
$C_{46}H_{68}NO_3PS$; FW: 746.1; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



PHOSPHORUS (Compounds)

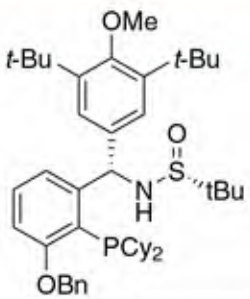
15-8466 NEW — 25mg

[S(R)]-N-[(S)-[3,5-Di-tert-butyl-4-methoxyphenyl][(3-benzyloxy-2-(dicyclohexylphosphino) phenyl)methyl]-2-methyl-2-propanesulfinamide, 95%

$C_{45}H_{66}NO_3PS$; FW: 732.1; white to off-white pwdr.

air sensitive, moisture sensitive

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



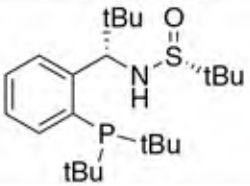
15-8504 NEW — 25mg

[S(R)]-N-[(1S)-1-[2-(Di-tert-butylphosphanyl) phenyl]-2,2-dimethylpropyl]-2-methyl-2-propanesulfinamide, 95%

$C_{23}H_{42}NOPS$; FW: 411.6; white to off-white pwdr.

air sensitive, moisture sensitive

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



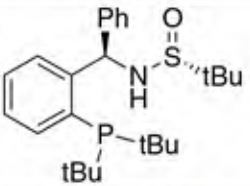
15-8502 NEW — 25mg

[S(R)]-N-[(1R)-1-[2-(Di-tert-butylphosphanyl) phenyl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{25}H_{38}NOPS$; FW: 431.6; white to off-white pwdr.

air sensitive, moisture sensitive

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



15-8500 NEW — 25mg

[S(R)]-N-[(1S)-1-[2-(Di-tert-butylphosphanyl)phenyl]phenylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{25}H_{38}NOPS$; FW: 431.6; white to off-white pwdr.

air sensitive, moisture sensitive

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

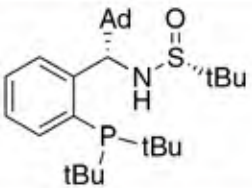
15-8492 NEW — 25mg

[S(R)]-N-[(S)-[2-(Di-tert-butylphosphino) phenyl]-adamantylmethyl]-2-methyl-2-propanesulfinamide, 95%

$C_{29}H_{48}NOPS$; FW: 489.7; white to off-white pwdr.

air sensitive, moisture sensitive

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



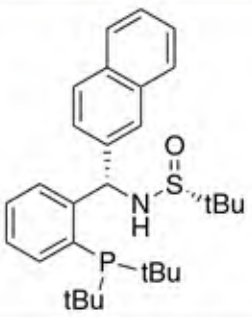
15-8494 NEW — 25mg

[S(R)]-N-[(S)-[2-(Di-tert-butylphosphino) phenyl[(2-naphthalenyl)methyl]-2-methyl-2-propanesulfinamide, 95%

$C_{29}H_{40}NOPS$; FW: 481.7; white to off-white pwdr.

air sensitive, moisture sensitive

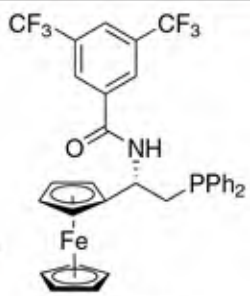
Note: Sold in collaboration with Daicel for research purposes only.



PHOSPHORUS (Compounds)

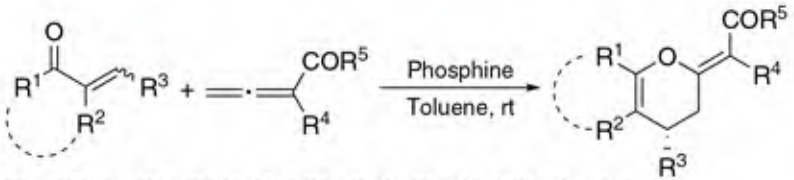
15-1840 NEW
n-Dodecylphosphonic acid, min. 90% *(5137-70-2)*
$CH_3(CH_2)_{11}P(O)(OH)_2$; FW: 250.31; white waxy solid; d. 0.4
1g
5g
25g

15-8510 NEW
N-[(1S)-(1-Ferrocenyl)-2-(diphenylphosphino) ethyl)]-3,5-bis(trifluoromethyl)-benzamide, 95% *(2131816-17-4)*
$C_{33}H_{26}F_6FeNOP$; FW: 653.4; yellow pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

Technical Note:
1. Ferrocene derived bifunctional phosphine catalyst for asymmetric oxa-[4+2] cycloaddition of α-ubstituted allenones with enones.

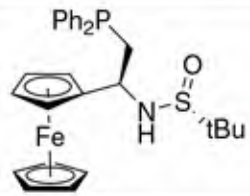


Tech. Note (1)
Ref. (1)

R^1 = CF3, Ar; R^2 = CN, H, Alkyl; R^3 = R_f, Ar; R^4 = Alkyl, R^5 = Ar, alkyl

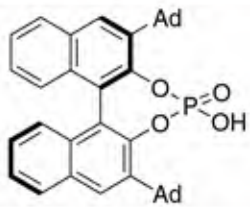
References:
1. *Chem. Eur. J.* **2017**, *23*, 13587.

15-8386 NEW
[S(R)]-N-[(1S)-1-Ferrocenylethyl-2-(diphenyl-phosphino)ethyl]-2-methyl-2-propanesulfin-amide, 95%
$C_{28}H_{32}FeNOPS$; FW: 517.4; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



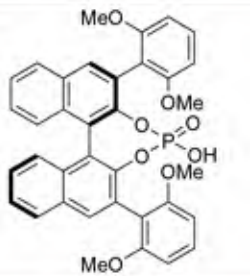
100mg

15-8540 NEW
(11bR)-4-Hydroxy-2,6-bis(adamantan-1-yl)-4-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepi-noxide, 95%
$C_{40}H_{41}O_4P$; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

15-8544 NEW
(11bR)-4-Hydroxy-2,6-bis(2,6-dimethoxy-phenyl)-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2] dioxaphosphepin, 98%
$C_{36}H_{29}O_8P$; FW: 620.6; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

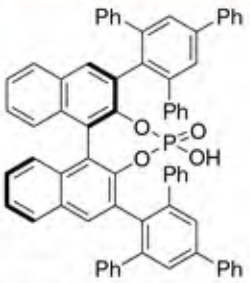


25mg
100mg

PHOSPHORUS (Compounds)

15-8534 NEW

(11bR)-4-Hydroxy-2,6-bis(5'-phenyl[1,1':3',1''-terphenyl]-2'-yl)-4-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepinoxide, 98%, (99% ee)
$C_{68}H_{45}O_4P$; FW: 957.1; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

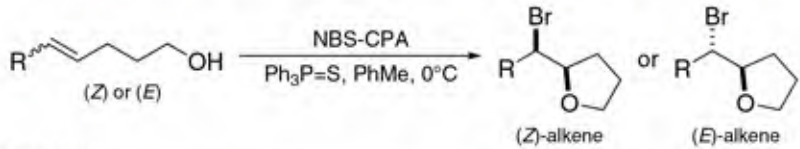
15-8535 NEW

(11bS)-4-Hydroxy-2,6-bis(5'-phenyl[1,1':3',1''-terphenyl]-2'-yl)-4-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepinoxide, 98%, (99% ee)
(1639447-03-2)
$C_{68}H_{45}O_4P$; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

Technical Note:

1. Used in the Lewis base/chiral Brønsted acid catalyzed enantioselective bromocycloetherification.



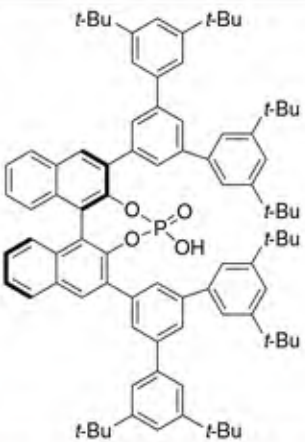
Tech. Note (1)
Ref. (1)

References:

1. *Chirality*, **2014**, *26*, 344.

15-8530 NEW

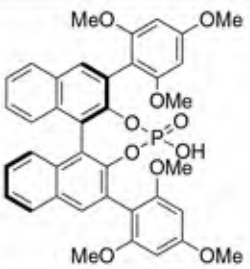
(4R)-4-Hydroxy-2,6-bis(3,3'',5,5''-tetrakis(tert-butyl)-[1,1':3',1''-terphenyl]-5'-yl)dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepine-4-oxide, 98%
$C_{88}H_{101}O_4P$; FW: 1253.7; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

15-8548 NEW

(11bR)-4-Hydroxy-2,6-bis(2,4,6-trimethoxyphenyl)-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%
$C_{38}H_{33}O_{10}P$; FW: 680.6; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

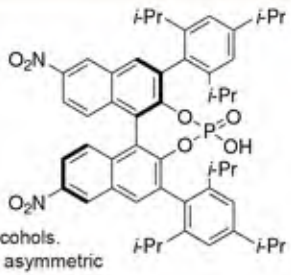
PHOSPHORUS (Compounds)

15-8550 NEW

(11bR)-4-Hydroxy-9,14-dinitro-2,6-bis[2,4,6-tris(1-methylethyl)phenyl]-4-oxide-Dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98% *(1535206-22-4)*

$C_{50}H_{55}N_2O_8P$; FW: 848; off white to light yellow pwdr.

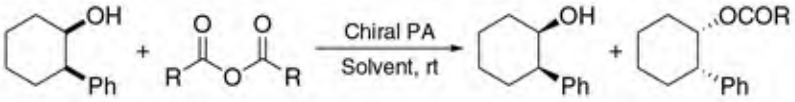
Note: Sold in collaboration with Daicel for research purposes only.



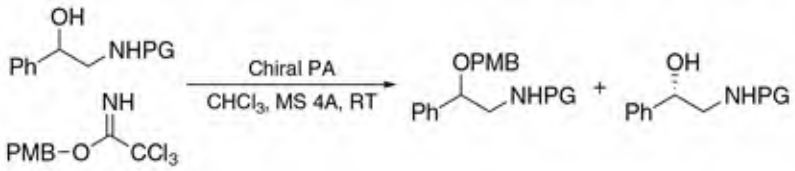
10mg
25mg

Technical Notes:

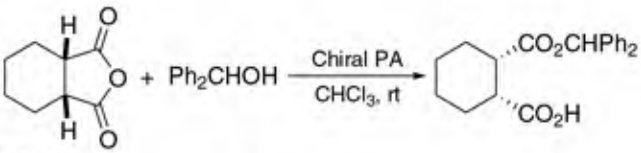
1. Organocatalyst used for the kinetic resolution of secondary alcohols.
2. Catalyst used in the kinetic resolution of β-amino alcohols via asymmetric substitutions at sp3-hybridized carbon atoms.
3. Brønsted acid catalyst used for asymmetric desymmetrization of α-symmetric acid anhydrides.



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



Tech. Note (3)
Ref. (3)

References:

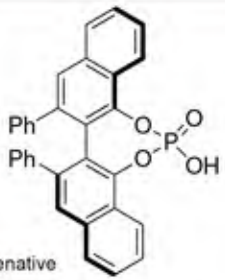
1. *Angew. Chem. Int. Ed.* **2013**, *52*, 10227.
2. *Angew. Chem. Int. Ed.* **2016**, *55*, 13137.
3. *Tetrahedron Lett.*, **2016**, *57*, 4098.

15-8558 NEW

(6aR)-14-Hydroxy-6,7-diphenyl-14-oxide-dinaphtho[1,2-d:2',1'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) *(956610-76-7)*

$C_{32}H_{21}O_4P$; FW: 500.5; off white to light yellow pwdr.

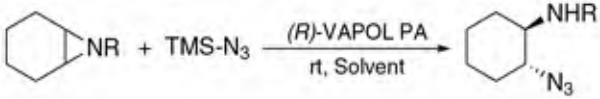
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

Technical Notes:

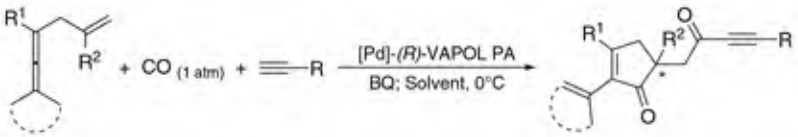
1. Organocatalyst for desymmetrization of meso-aziridines.
2. Used in the enantioselective Pd/Brønsted acid-catalyzed carbonylative carbocyclization of enallenes via cross-dehydrogenative coupling with terminal alkynes.



Tech. Note (1)
Ref. (1)

PHOSPHORUS (Compounds)

15-8558 ***(continued)*** **(6aR)-14-Hydroxy-6,7-diphenyl-14-oxide-dinaphtho[1,2-d:2',1'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)** *(956610-76-7)*

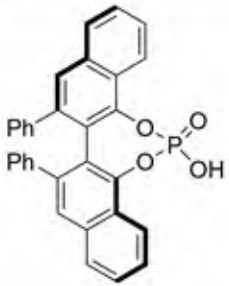


Tech. Note (2)
Ref. (2)

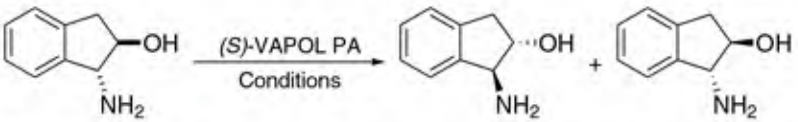
References:
1. *J. Am. Chem. Soc.* **2007**, *129*, 12084.
2. *Angew. Chem. Int. Ed.* **2017**, *56*, 4535.

15-8559 NEW **(6aS)-14-Hydroxy-6,7-diphenyl-14-oxide-dinaphtho[1,2-d:2',1'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)** *(175223-61-7)*
$C_{32}H_{21}O_4P$; FW: 500.5; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg



Technical Note:
1. Used in the enantioselective racemic resolution of a range of 1,2-amino via liquid-liquid extraction of alcohols.

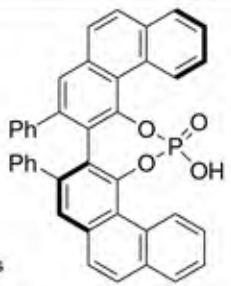


Tech. Note (1)
Ref. (1)

References:
1. *ChemSusChem* **2018**, *11*, 178.

15-8554 NEW **(8aR)-18-Hydroxy-8,9-diphenyl-18-oxide-diphenanthro[4,3-d:3',4'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)** *(871130-18-6)*
$C_{40}H_{25}O_4P$; FW: 600.6; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

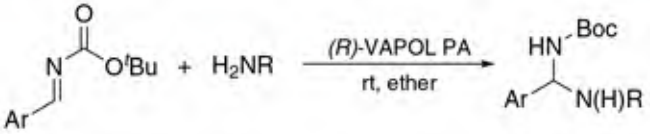
25mg
100mg



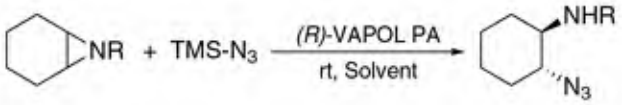
Technical Notes:
1. Organocatalyst for amidation of imines.
2. Organocatalyst for desymmetrization of meso-aziridines.
3. Chiral Brønsted acid used in catalytic asymmetric aza-Darzens aziridine synthesis.
4. Organocatalyst for the remote α-C–H bond activation of alcohols or amines triggered by the radical trifluoromethylation of alkenes.
5. Used in the enantioselective Pd/Brønsted acid-catalyzed carbonylative carbocyclization of enallenes via cross-dehydrogenative coupling with terminal alkynes.
6. Used in the enantioselective synthesis of tropanes via Brønsted acid catalyzed pseudotransannular desymmetrization.
7. Cu-catalyst used in Cu/achiral pyridine ligand catalyzed enantioselective radical oxytrifluoromethylation of alkenes with alcohols.

PHOSPHORUS (Compounds)

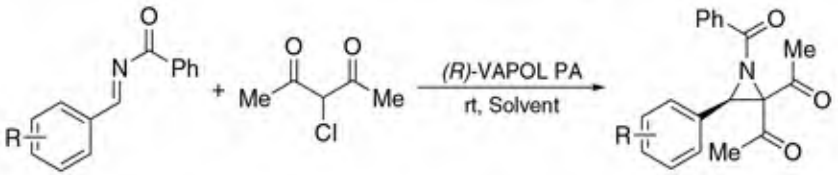
15-8554 **(8aR)-18-Hydroxy-8,9-diphenyl-18-oxide-diphenanthro[4,3-d:3',4'-f][1,3,2]dioxaphosphepin,**
(continued) **98%, (99% ee)** *(871130-18-6)*



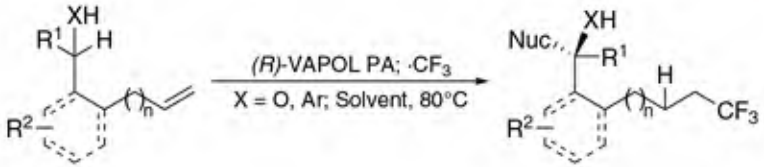
Tech. Note (1)
Ref. (1)



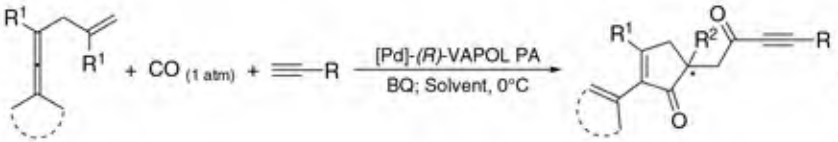
Tech. Note (2)
Ref. (2)



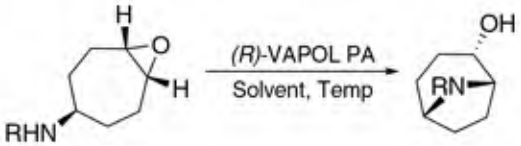
Tech. Note (3)
Ref. (3)



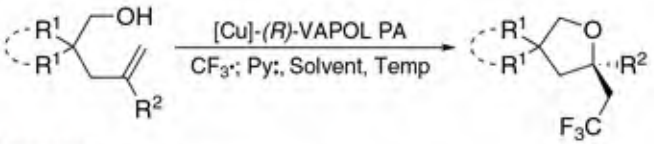
Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)

References:

1. *J. Am. Chem. Soc.* **2005**, *127*, 15696.
2. *J. Am. Chem. Soc.* **2007**, *129*, 12084.
3. *Org. Lett.* **2011**, *13*, 2188.
4. *Org. Chem. Front.*, **2017**, *4*, 2139.
5. *Angew. Chem. Int. Ed.* **2017**, *56*, 4535.
6. *Angew. Chem. Int. Ed.* **2017**, *56*, 8883.
7. *Angew. Chem. Int. Ed.* **2020**, *59*, 6780.

PHOSPHORUS (Compounds)

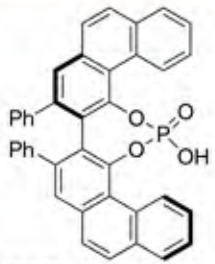
15-8555 NEW

(8aS)-18-Hydroxy-8,9-diphenyl-18-oxide-diphenanthro[4,3-d:3',4'-f][1,3,2]dioxaphosphepin, 98%, (99% ee) 25mg 100mg

(871130-17-5)

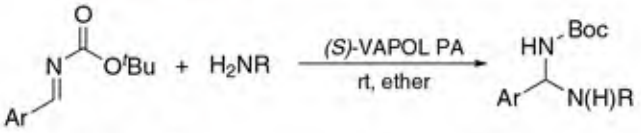
$C_{40}H_{25}O_4P$; FW: 600.6; light yellow to yellow pwdr

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

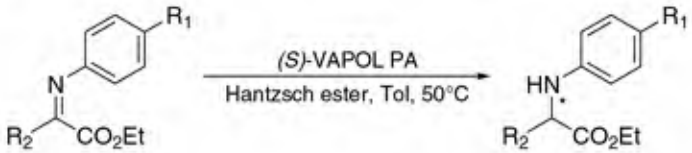


Technical Notes:

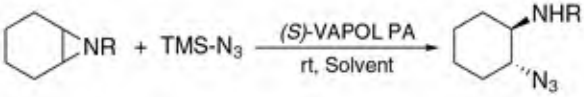
1. Organocatalyst for amidation of imines.
2. Organocatalyst for asymmetric reduction of α-imino esters to generate α-amino esters.
3. Organocatalyst for desymmetrization of meso-aziridines.
4. Organocatalyst for the highly enantioselective addition of indoles to N-acyl imines.
5. Organocatalyst for the enantioselective Friedel-Crafts reaction of pyrrole derivatives with imines.
6. Organocatalyst for the desymmetrization of meso-aziridines with functionalized mercaptans.
7. Organocatalyst for highly enantioselective benzoyloxylation of 3-aryloxindoles.
8. Used in for the Ca/Chiral phosphoric acid catalyzed asymmetric chlorination and Michael Reactions of 3-substituted oxindoles.



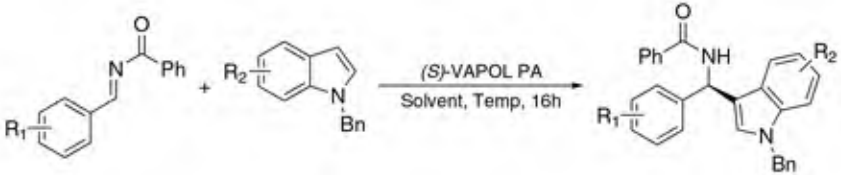
Tech. Note (1)
Ref. (1-2)



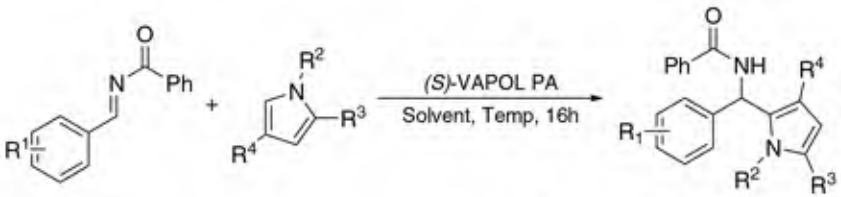
Tech. Note (2)
Ref. (3)



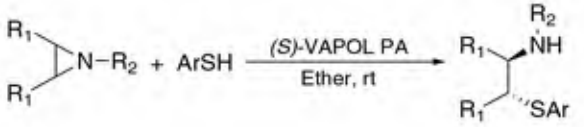
Tech. Note (3)
Ref. (4)



Tech. Note (4)
Ref. (5)



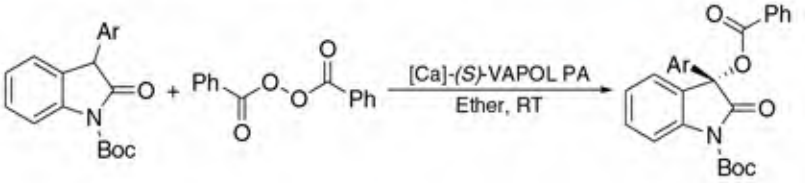
Tech. Note (5)
Ref. (6)



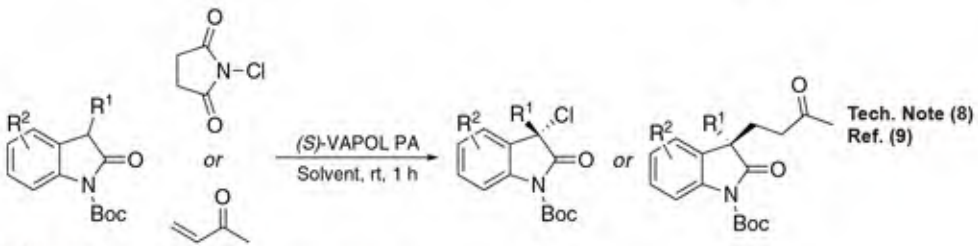
Tech. Note (6)
Ref. (7)

PHOSPHORUS (Compounds)

15-8555 ***(continued)*** **(8aS)-18-Hydroxy-8,9-diphenyl-18-oxide-diphenanthro[4,3-d:3',4'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)** *(871130-17-5)*



Tech. Note (7)
Ref. (8)



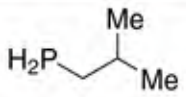
Tech. Note (8)
Ref. (9)

References:

1. *J. Am. Chem. Soc.* **2005**, *127*, 15696.
2. *Chem. Commun.*, **2007**, 4477.
3. *J. Am. Chem. Soc.* **2007**, *129*, 5830.
4. *J. Am. Chem. Soc.* **2007**, *129*, 12084.
5. *Org. Lett.* **2007**, *9*, 2609.
6. *Org. Lett.* **2007**, *9*, 4065.
7. *Org. Lett.* **2009**, *11*, 5186.
8. *Angew. Chem. Int. Ed.* **2011**, *50*, 1135.
9. *J. Am. Chem. Soc.* **2011**, *133*, 3339.

15-7560 NEW

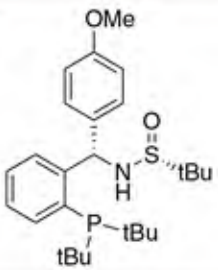
Isobutylphosphine, min. 95%, CYTOP® 141
(4023-52-3)
$C_4H_9PH_2$; FW: 90.11; Colorless liquid; b.p. 78 °C; d. 0.77
air sensitive, moisture sensitive, pyrophoric
Note: Sold in collaboration with Solvay.



25g
100g

15-8498 NEW

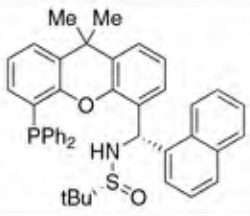
[S(R)]-N-[(S)-(4-Methoxyphenyl)[2-(di-tert-butylphosphino)phenyl]methyl]-2-methyl-2-propanesulfinamide, 95%
$C_{26}H_{40}NO_2PS$; FW: 461.6; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



25mg

15-8416 NEW

[S(R)]-N-[(S)-(1-naphthalenyl)[5-(diphenylphosphino)-9,9-dimethyl-9H-xanthen-4-yl]methyl]-2-methyl-2-propanesulfinamide, 95%
$C_{42}H_{40}NO_2PS$; FW: 653.8; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

PHOSPHORUS (Compounds)

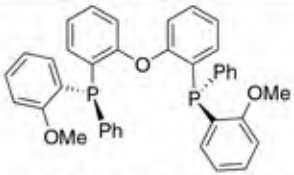
15-0558 NEW

(11bS)-8,9,10,11,12,13,14,15-Octahydro-4-hydroxy-2,6-bis[3,5-bis[3,5-bis(trifluoromethyl)phenyl]phenyl]-4-oxide-dinaphtho[2,1-d:1',2'-f][1,3,2]dioxaphosphepin, 98%, (99% ee)
$C_{64}H_{39}F_{24}O_4P$; FW: 1358.9; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-1279 NEW

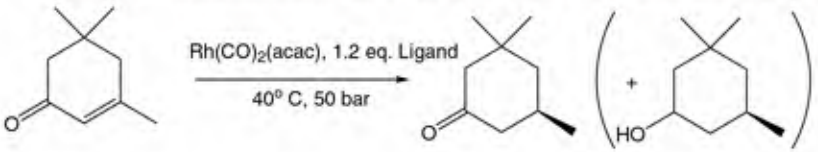
(1S,1'S)-(-)-(Oxybis(2,1-phenylen))bis((2-methoxyphenyl)(phenyl)phosphine), min. 97% *(2119686-55-2)*
$C_{38}H_{32}O_3P_2$; FW: 598.61 ; white to off-white solid
air sensitive, moisture sensitive, (store cold)
Note: Sold under license of WO2017/191310 for research purposes only.



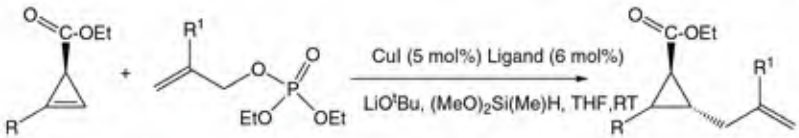
25mg
100mg

Technical Notes:

1. P-Chirogenic Xantphos ligand used for the synthesis and application in Rhodium-catalyzed asymmetric hydrogenation.
2. Diastereo- and enantioselective copper catalyzed hydroallylation of disubstituted cyclopropenes.



Tech. Note (1)
Ref. (1)



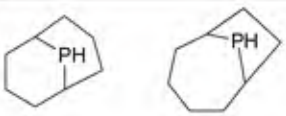
Tech. Note (2)
Ref. (2)

References:

1. *ACS Catal.*, **2017**, *7*, 6162−6169.
2. *Chem. Sci.*, **2018**, *9*, 6503-6508.

15-7535 NEW

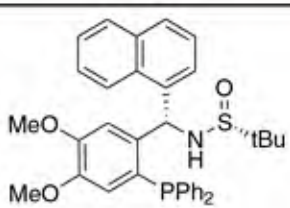
9-Phosphabicyclononanes in toluene, mixture of isomers, CYTOP® 282T *(13887-02-0)*
$C_8H_{15}P$; FW: 142.17; Colorless to pale yellow liq.; f.p. 41 °F; d. 0.94
air sensitive, moisture sensitive
Note: Sold in collaboration with Solvay.



100g
500g

15-8362 NEW

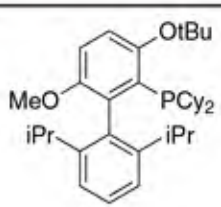
[S(R)]-N-[(S)-[2-(Diphenylphosphino)-4,5-dimethoxyphenyl]-1-naphthalenylmethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{35}H_{36}NO_3PS$; FW: 581.7; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

15-3035 NEW

(3-(Tert-butoxy)-2',6'-diisopropyl-6-methoxy-[1,1'-biphenyl]-2-yl)dicyclohexylphosphane GPhos, 98% *(2489243-29-8)*
$C_{35}H_{53}O_2P$; FW: 536.78; white xtl.; m.p. 240
Note: Patents: US 6,395,916, US 6,307,087



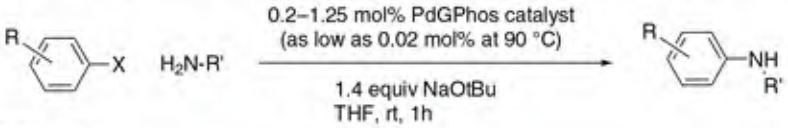
50mg
250mg

PHOSPHORUS (Compounds)

15-3035 ***(continued)*** **(3-(Tert-butoxy)-2',6'-diisopropyl-6-methoxy-[1,1'-biphenyl]-2-yl)dicyclohexylphosphane GPhos, 98%** *(2489243-29-8)*

Technical Note:

1. Novel mono-phosphine Buchwald ligand that supports a catalyst of improved stability. The GPhos-derived catalyst exhibits improved performance for room temperature C–N cross coupling reactions between a broad scope of primary amines and aryl halides.[1] The ligand is designed to promote C–N cross coupling across a wide range of substrate classes with low catalyst loadings. It shows an improved relative rate of productive catalysis versus catalyst deactivation compared to previous catalysts. The GPhos-supported catalyst exhibits better reactivity than previous catalysts both under ambient conditions and at elevated temperatures. Its use allows for the coupling of a variety of primary amine and aniline nucleophiles, including (1) unhindered, (2) five-membered-ring N-heterocycle-containing, and (3) α-tertiary primary amines, each of which previously required a different catalyst to achieve optimal results. The GPhos-supported catalyst is also well suited for coupling electron-deficient anilines as well as N-heterocycle-containing aryl halides and amines.



Tech. Note (1)
Ref. (1)

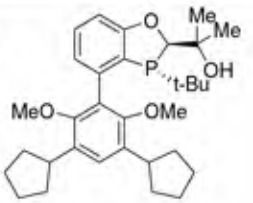
References:

1. *J. Am. Chem. Soc.*, **2020**, *142*, 35, 15027.

15-6910 NEW **2-((2R,3R)-3-(tert-Butyl)-4-(3,5-dicyclopentyl-2,6-dimethoxyphenyl)-2,3-dihydrobenzo[d][1,3]oxaphosphol-2-yl)propan-2-ol, min. 97%, (99% ee) (2R,3R)-Baryphos** *(2416226-97-4)*

$C_{32}H_{45}O_4P$; FW: 524.68; white solid

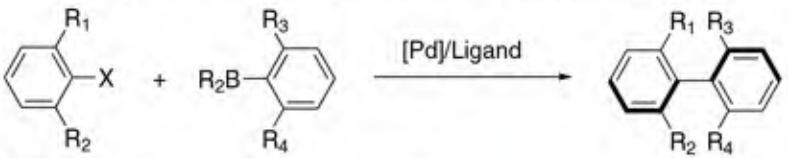
Note: Sold under license from Zejun for research purposes only. Patents: ZL2013105048267, CN104558038.



25mg
100mg
500mg

Technical Note:

1. Ligand/palladium catalyst for asymmetric Suzuki-Miyaura cross-coupling reactions.



Tech. Note (1)
Ref. (1)

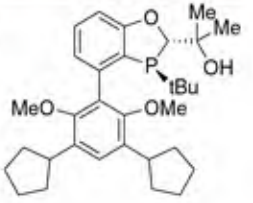
References:

1. *J. Am. Chem. Soc.* **2020**, *142*, 8036–8043

15-6911 NEW **2-((2S,3S)-3-(tert-Butyl)-4-(3,5-dicyclopentyl-2,6-dimethoxyphenyl)-2,3-dihydrobenzo[d][1,3]oxaphosphol-2-yl)propan-2-ol, min. 97%, (99% ee) (2S,3S)-Baryphos** *(2416226-68-9)*

$C_{32}H_{45}O_4P$; FW: 524.68; white solid

Note: Sold under license from Zejun for research purposes only. Patents: ZL2013105048267, CN104558038.

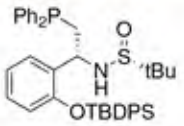


25mg
100mg
500mg

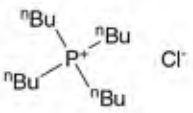
Technical Note:

1. See 15-6910 (page 85)

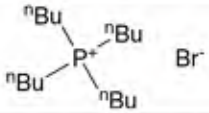
PHOSPHORUS (Compounds)

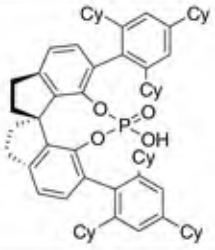
15-8390 NEW
[S(R)]-N-[(1R)-1-[2-((tert-Butyldiphenylsilyl)oxy) phenyl)]-2-yl-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{40}H_{48}NO_2PSSi$; FW: 663.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.

50mg

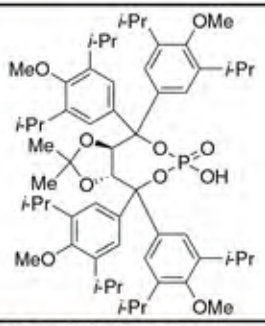
15-8388 NEW
[S(R)]-N-[(1S)-1-[2-((tert-Butyldiphenylsilyl)oxy)phenyl)]-2-yl-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{40}H_{48}NO_2PSSi$; FW: 663.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.
50mg

15-7620 NEW
Tetrabutylphosphonium chloride (68-72 wt% solution in methanol) *(2304-30-5)*
$C_{16}H_{36}ClP$; FW: 294.88; Pale yellow liq.; f.p. 52 °F; d. 0.9

100g
500g

15-7625 NEW
Tetrabutylphosphonium chloride (49-51 wt% solution in toluene)
(2304-30-5)
$C_{16}H_{36}ClP$; FW: 294.88; Pale yellow liq.; f.p. 43 °F
100g
500g

15-1579 NEW
Tetrabutyphosphonium bromide (75% in water)
(3115-68-2)
$(C_4H_9)_4P+Br$-; FW: 339.35; colorless to light brown liq.; f.p. >2200 °F; d. 1.06

100g
500g

15-8596 NEW
(11aR)-10,11,12,13-Tetrahydro-5-hydroxy-3,7-bis[2,4,6-tricyclohexylphenyl]-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%
$C_{85}H_{93}O_4P$; FW: 959.3; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

10mg
25mg

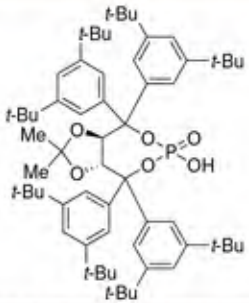
15-8612 NEW
(3aR,8aR)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetrakis(3,5-diisopropyl-4-methoxyphenyl)-6-oxide-[1,3]dioxolo[4,5-e][1,3,2] dioxaphosphepine, 98%
$C_{59}H_{85}O_{10}P$; FW: 985.3; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-8613 NEW
(3aS,8aS)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetrakis(3,5-diisopropyl-4-methoxyphenyl)-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%
$C_{59}H_{85}O_{10}P$; FW: 985.3; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.
25mg
100mg

PHOSPHORUS (Compounds)

15-8617 NEW

(3aR,8aR)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetrakis(3,5-di-tert-butylphenyl)-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)
98%, (99% ee)
$C_{63}H_{93}O_6P$; FW: 977.4; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

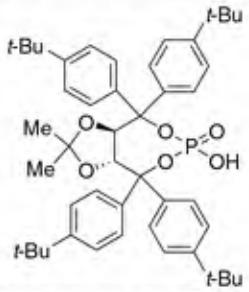
15-8618 NEW

(3aS,8aS)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetrakis(3,5-di-tert-butylphenyl)-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)
$C_{63}H_{93}O_6P$; FW: 977.4; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-8608 NEW

(3aR,8aR)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetrakis(4-(tert-butyl)phenyl)-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)
$C_{47}H_{61}O_6P$; FW: 753; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

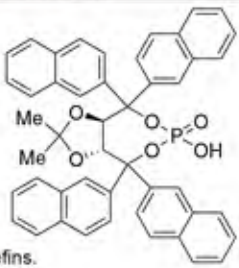
15-8609 NEW

(3aS,8aS)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetrakis(4-(tert-butyl)phenyl)-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)
$C_{47}H_{61}O_6P$; FW: 753; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only

25mg
100mg

15-8602 NEW

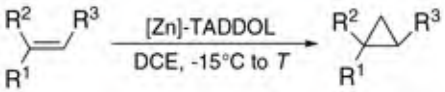
(3aR,8aR)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetra-2-naphthalenyl-6-oxide-1,3-dioxolo[4,5-e][1,3,2]dioxaphosphepin, 98%, (99% ee) *(952649-50-2)*
$C_{47}H_{37}O_6P$; FW: 728.8; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

Technical Note:

1. Ligand for the Zn-catalyzed asymmetric Simmons-Smith cyclopropanation of both functionalized and unfunctionalized olefins.



Tech. Note (1)
Ref. (1)

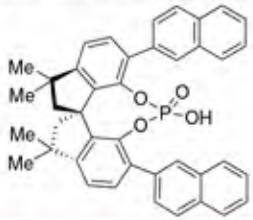
References:

1. *Adv. Synth. Catal.* **2006**, *348*, 2363.

PHOSPHORUS (Compounds)

15-8603 NEW
(3aS,8aS)-Tetrahydro-6-hydroxy-2,2-dimethyl-4,4,8,8-tetra-2-naphthalenyl-6-oxide-1,3-dioxolo[4,5-e][1,3,2]dioxaphosphepin, 98%, (99% ee)
$C_{47}H_{37}O_6P$; FW: 728.8; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.
25mg 100mg

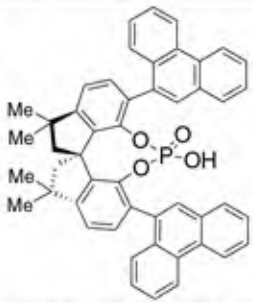
15-8566 NEW
(11aR)-10,11,12,13-Tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-3,7-di-2-naphthalenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)
$C_{41}H_{35}O_4P$; FW: 622.7; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg 100mg

15-8567 NEW
(11aS)-10,11,12,13-Tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-3,7-di-2-naphthalenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)
$C_{41}H_{35}O_4P$; FW: 622.7; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.
25mg 100mg

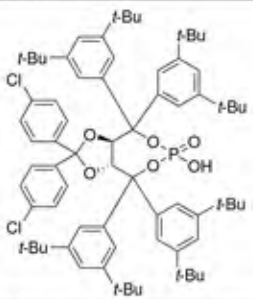
15-8572 NEW
(11aR)-10,11,12,13-Tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)
$C_{49}H_{39}O_4P$; FW: 722.8; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg 100mg

15-8573 NEW
(11aS)-10,11,12,13-Tetrahydro-10,10,13,13-tetramethyl-5-hydroxy-3,7-di-9-phenanthrenyl-5-oxide-diindeno[7,1-de:1',7'-fg][1,3,2]dioxaphosphocin, 98%, (99% ee)
$C_{49}H_{39}O_4P$; FW: 722.8; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.
25mg 100mg

15-8629 NEW
(3aR,8aR)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-2,2-bis(4-chlorophenyl)-6-hydroxy-tetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 95%, (99% ee)
$C_{73}H_{95}Cl_2O_6P$; FW: 1170.4; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg 100mg

15-8630 NEW
(3aS,8aS)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-2,2-bis(4-chlorophenyl)-6-hydroxy-tetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 95%, (99% ee)
$C_{73}H_{95}Cl_2O_6P$; FW: 1170.4; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.
25mg 100mg

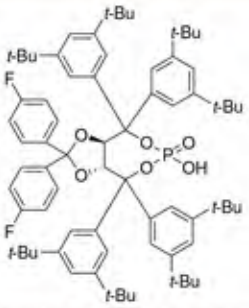
PHOSPHORUS (Compounds)

15-8625 NEW

(3aR,8aR)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-2,2-bis(4-fluorophenyl)-6-hydroxytetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)

$C_{73}H_{95}F_2O_6P$; FW: 1137.5; off white to light yellow pwdr.

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



25mg
100mg

15-8626 NEW

(3aS,8aS)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-2,2-bis(4-fluorophenyl)-6-hydroxy-tetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%

$C_{73}H_{95}F_2O_6P$; FW: 1137.5; off white to light yellow pwdr.

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

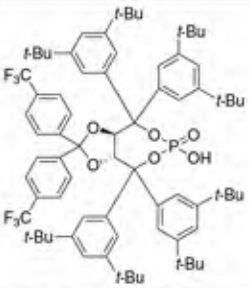
25mg
100mg

15-8634 NEW

(3aR,8aR)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-6-hydroxy-2,2-bis(4-(trifluoromethyl)phenyl)tetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%

$C_{75}H_{95}F_6O_6P$; FW: 1237.5; off white to light yellow pwdr.

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



25mg
100mg

15-8635 NEW

(3aS,8aS)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-6-hydroxy-2,2-bis(4-(trifluoromethyl)phenyl)tetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%

$C_{75}H_{95}F_6O_6P$; FW: 1237.5; off white to light yellow pwdr.

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

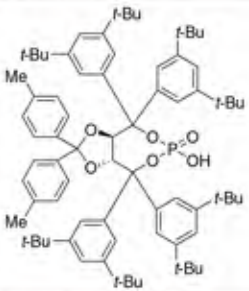
25mg
100mg

15-8638 NEW

(3aR,8aR)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-6-hydroxy-2,2-di-p-tolyltetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)

$C_{75}H_{101}O_6P$; FW: 1129.6; off white to light yellow pwdr.

Note: Sold in collaboration with Daicel for esearch purposes only.



25mg
100mg

15-8639 NEW

(3aS,8aS)-4,4,8,8-Tetrakis(3,5-di-tert-butylphenyl)-6-hydroxy-2,2-di-p-tolyltetrahydro-6-oxide-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)

$C_{75}H_{101}O_6P$; FW: 1129.6; off white to light yellow pwdr.

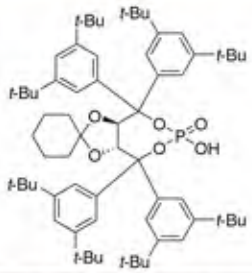
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

PHOSPHORUS (Compounds)

15-8621 NEW

(3a'R,8a'R)-4',4',8',8'-Tetrakis(3,5-di-tert-butylphenyl)-6'-hydroxy-tetrahydrospiro[cyclohexane-1,2'-6'-ox[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)
$C_{66}H_{97}O_6P$; FW: 1017.4; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.



25mg
100mg

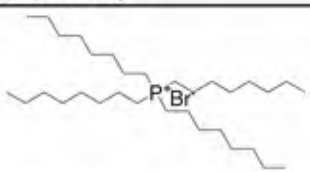
15-8622 NEW

(3a'S,8a'S)-4',4',8',8'-Tetrakis(3,5-di-tert-butylphenyl)-6'-hydroxy-tetrahydrospiro[cyclohexane-1,2'-6'-ox[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepine, 98%, (99% ee)
$C_{66}H_{97}O_6P$; FW: 1017.4; off white to light yellow pwdr.
Note: Sold in collaboration with Daicel for research purposes only.

25mg
100mg

15-7630 NEW

Tetraoctylphosphonium bromide (45-55 wt% in toluene) *(23906-97-0)*
$C_{32}H_{68}BrP$; FW: 563.76; Colorless to pale yellow liq.; f.p. 43 °F
hygroscopic



100g
500g

Technical Notes:

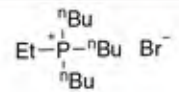
1. Thermally stable, soluble quaternary phosphonium derivative used in metal separation[1] and lubricant additive applications[2].
2. Catalyst for the oxidation of alkyl aromatic compounds[3] and preparation of mononitrated aromatic compounds[4].

References:

1. *Green Chemistry*, **2012**, *14*, 1657-1665.
2. US20150232777A1.
3. US9932287B2.
4. WO2012156540A3.

15-7580 NEW

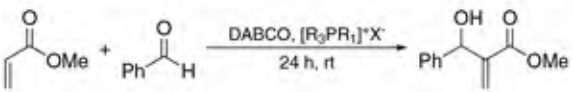
Tributyl(ethyl)phosphonium bromide, min. 95% (45-55% in water), CYPHOS® IL 676W *(7392-50-9)*
$C_{14}H_{32}BrP$; FW: 311.29; Colorless to pale yellow liq.
Note: Sold in collaboration with Solvay.



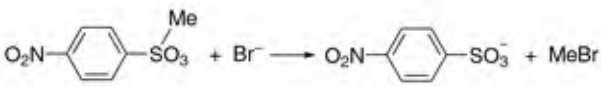
100g
500g

Technical Notes:

1. CYPHOS® IL 676W has been used in phase transfer catalysis [1].
2. CYPHOS® IL 676W is an effective in aluminum electroplating [2].
3. CYPHOS® IL 676W has also been exploited in organic transformations as a cocatalyst [3].
4. CYPHOS® IL 676W has been observed to increase the SN2 reactions rate of sulfonate esters with bromide ion [5].
5. CYPHOS® IL 676W has been demonstrated effective at capturing SO2 from flue gas [5].



Tech. Note (3)
Ref. (3)



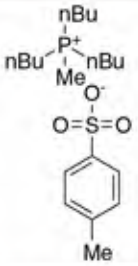
Tech. Note (4)
Ref. (4)

PHOSPHORUS (Compounds)

15-7580 (***continued***) **Tributyl(ethyl)phosphonium bromide, min. 95% (45-55% in water), CYPHOS® IL 676W** *(7392-50-9)*

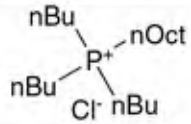
References:
1. JP Patent 02304061, Dec. 17, **1990**.
2. JP Patent 04021794, Jan. 24, **1992**.
3. *Tetrahedron Lett.* **2004**, *45*, 7359.
4. *J. Phys. Org. Chem.* **2006**, *19*, 281.
5. *AIChE*, **2015**, *6*, 2028.

15-7570 NEW **Tributylmethylphosphonium p-toluenesulfonate, min. 95% (45-55% in water), CYPHOS® IL 120W** *(55767-12-9)*
$C_{13}H_{30}P(C_7H_7O_3S)$; FW: 388.55; Colorless to pale yellow liq.
Note: Sold in collaboration with Solvay.



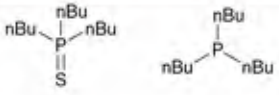
100g
500g

15-7575 NEW **Tributyl(octyl)phosphonium chloride, min. 93%, CYPHOS® IL 253** *(56315-19-6)*
$C_{20}H_{44}ClP$; FW: 351.00; Colorless to pale yellow viscous liq.; b.p. >2200 °C; f.p. 306 °F; d. 0.92
Note: Sold in collaboration with Solvay.



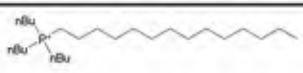
100g
500g

15-7615 NEW **Tributylphosphine sulfide/tributylphosphine (50:50 mixture), CYTOP® 506** *(3084-50-2)*
$C_{12}H_{27}PS/C_{12}H_{27}P$; Colorless to amber liq.; f.p. >2212 °F
air sensitive, moisture sensitive
Note: Sold in collaboration with Solvay.



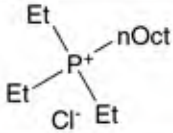
25g
100g
500g

15-7585 NEW **Tributyltetradecyl phosphonium chloride, (ca. 50% in water), CYPHOS® 4345W** *(81741-28-8)*
$C_{26}H_{56}ClP$; FW: 435.16; Yellow green viscous liq.; d. 0.95
Note: Sold in collaboration with Solvay.



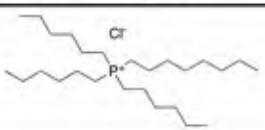
100g
500g

15-7565 NEW **Triethyl(octyl)phosphonium chloride (45-55% solution), CYPHOS® IL 541W** *(482647-71-2)*
$C_{14}H_{32}ClP$; FW: 266.83; Colorless to pale yellow liq.
Note: Sold in collaboration with Solvay.



100g
500g

15-7590 NEW **Trihexyl(octyl)phosphonium chloride, min. 95%, CYPHOS® IL 356** *(850134-85-9)*
$C_{26}H_{56}ClP$; FW: 435.16; Colorless to pale yellow liq.; f.p. >230 °F
Note: Sold in collaboration with Solvay.

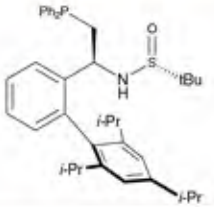


100g
500g

PHOSPHORUS (Compounds)

15-8374 NEW

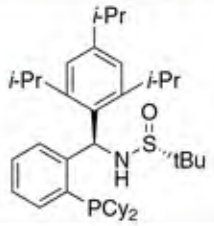
[S(R)]-N-[(1S)-1-(2',4',6'-Triisopropyl)-(1,1'-biphenyl)-2-yl-2-(diphenylphosphino)ethyl]-2-methyl-2-propanesulfinamide, 95%
$C_{39}H_{50}NOPS$; FW: 611.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

15-8456 NEW

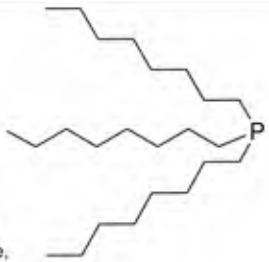
[S(R)]-N-[(R)-[2,4,6-(Triisopropylphenyl)) methyl]-4-methoxyphenyl][2-(dicyclohexylphosphino)phenyl]methyl]-2-methyl-2-propanesulfinamide, 95%
$C_{38}H_{60}NOPS$; FW: 609.9; white to off-white pwdr.
air sensitive, moisture sensitive
Note: Sold in collaboration with Daicel for research purposes only.



50mg

15-6665 NEW

Tri-n-octylphosphine, min. 90% *(4731-53-7)*
$(C_8H_{17})_3P$; colorless to pale yellow liq.; f.p. >2200 °F; d. 0.83
air sensitive



100g
500g

Technical Notes:

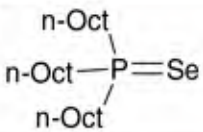
1. Ligand used in the manufacture of nanocrystals, specifically quantum dots.[1]
2. A General Phosphorus Source for the Low-Temperature Conversion of Metals into Metal Phosphides.[2]
3. Raw material for chalcogenides TOP=E (E = O, S, Se), used for II-VI semiconductor nanoparticles such as CdSe and CdTe, and IV-VI nanoparticles, such as PbSe.

References:

1. *Physika E*, **2017**, *90*, 175-182.
2. *Chem. Mater.* **2007**, *19*, 17, 4234–4242.
3. *Mater. Chem.* **2010**, *20*, 5797-5809.

15-6659 NEW

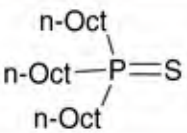
Trioctylphosphine selenide min. 80% *(20612-73-1)*
$(C_8H_{17})_3PSe$; FW: 449.59; colorless to pale yellow liq.; f.p. >230 °F; d. 0.9
STENCH



25g
100g
500g

15-7550 NEW

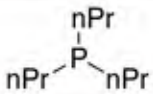
Trioctylphosphine sulfide, CYTOP® 505 *(2551-53-3)*
$C_{24}H_{51}PS$; FW: 402.71; colorless to pale yellow liq.; f.p. 230 °F; d. 0.89
Note: Sold in collaboration with Solvay.



25g
100g
500g

15-7610 NEW amp

Tripropylphosphine, min. 98%, CYTOP® 330 *(2234-97-1)*
$C_9H_{21}P$; FW: 160.24; Colorless liq.; d. 0.8
air sensitive, moisture sensitive, pyrophoric
Note: Sold in collaboration with Solvay.



50g
250g

PHOTOCHEMICAL EQUIPMENT (Other)

98-7850 NEW — **EvoluChem™ Light proofing upgrade** — 1 ea
Note: This item is compatible with the EvoluChem™ PhotoRedOx Box (98-7500 & 98-7550). Sold in collaboration with HepatoChem.

98-7975 NEW — **EvoluChem™ PhotoRedOx Box Light Source - Electric Power PAR20-18W, LG, Wavelength 380nm, 25 degrees, 100-240V AC** — 1 ea

Note: This item is compatible with the EvoluChem™ PhotoRedOx Box (98-7500 & 98-7550). A light source is required for use of the PhotoRedOx Box. For related products, see www.strem.com/evoluchem. Sold in collaboration with HepatoChem.

98-7950 NEW — **EvoluChem™ PhotoRedOx Box Light Source - Wavelength 365nm, Electric Power 18W** — 1ea

Note: This item is compatible with the EvoluChem PhotoRedOx Box (98-7500 & 98-7550). A light source is required for use of the PhotoRedOx Box. For related products see www.strem.com/evoluchem. Sold in collaboration with HepatoChem.

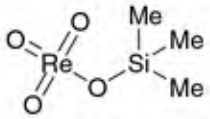
98-7780 NEW — **EvoluChem™ PhotoRedOx Box Photochemistry Holder - 2 x 20 ml vials** — 1ea
Note: This item is compatible with the EvoluChem PhotoRedOx Box (98-7500 & 98-7550). A photochemistry holder is required for use of the PhotoRedOx Box. For additional holder options, please see www.strem.com/evoluchem . Sold in collaboration with HepatoChem.

98-7790 NEW — **EvoluChem™ PhotoRedOx Box Photochemistry Holder - 8 x 4 ml vials** — 1 ea
Note: This item is compatible with the EvoluChem™ PhotoRedOx Box (98-7500 & 98-7550). A photochemistry holder is required for use of the PhotoRedOx Box. For additional holder options, please see www.strem.com/evoluchem .
Sold in collaboration with HepatoChem.

98-7550 NEW — **EvoluChem™ PhotoRedOx Box (Temperature controlled)** — 1 ea
Note: Sold in collaboration with HepatoChem.

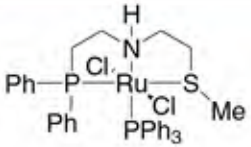
RHENIUM (Compounds)

75-4200 NEW — **Trimethylsilyl perrhenate, 98% (99.999%-Re)** — 250mg, 1g, 5g
PURATREM *(16687-12-0)*
$ReO_3OSi(CH_3)_3$; FW: 323.39; white solid; m.p. 79.5-80.5
air sensitive, light sensitive, moisture sensitive, hygroscopic

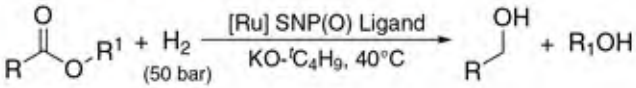


RUTHENIUM (Compounds)

44-3210 NEW — **Dichloro[N-[2-(diphenylphosphino-κP)ethyl]-2-(methylthio-κS)ethanamine-κN](triphenylphosphine) ruthenium** — 50mg
$C_{35}H_{37}Cl_2NP_2RuS$; FW: 737.67; yellow solid



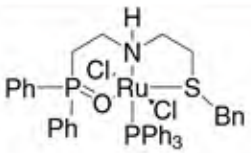
Technical Note:
1. Catalyst for selective ester hydrogenation.



Tech. Note (1)
Ref. (1)

References:
1. *Org. Process Res. Dev.* **2020**, *24*, 415.

44-3245 NEW — **Dichloro[rel-[N(S)]-N-[2-(diphenylphosphinyl-κO)ethyl]-2-[(R)-benzylthio-κS]ethanamine-κN](triphenylphosphine) ruthenium** — 50mg
$C_{41}H_{41}Cl_2NOP_2RuS$; FW: 829.76; magenta pwdr.
air sensitive
Note: Patents: US20170088571A1;
U.S. Provisional Patent Application No. 62/827,627.

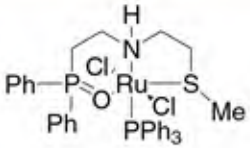


Technical Note:
1. See 44-3210 (page 93)

RUTHENIUM (Compounds)

44-3230 NEW

Dichloro[rel-[N(S)]-N-[2-(diphenylphosphinyl-κO)ethyl]-2-[(R)-methylthio-κS]ethanamine-κN](triphenylphosphine) ruthenium
(1839552-42-9)
$C_{35}H_{37}Cl_2NOP_2RuS$; FW: 753.66; brick red solid
moisture sensitive
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.

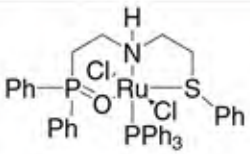


100mg

Technical Note:
1. See 44-3210 (page 93)

44-3240 NEW

Dichloro[rel-[N(S)]-N-[2-(diphenylphosphinyl-κO)ethyl]-2-[(R)-phenylthio-κS]ethanamine-κN](triphenylphosphine) ruthenium
$C_{40}H_{39}Cl_2NOP_2RuS$; FW: 815.74; dark red xtl.
air sensitive
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.

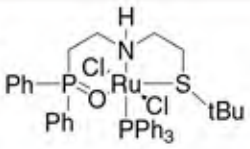


50mg

Technical Note:
1. See 44-3210 (page 93)

44-3235 NEW

Dichloro[rel-[N(S)]-N-[2-(diphenylphosphinyl-κO)ethyl]-2-[(R)-tert-butylthio-κS]ethanamine-κN](triphenylphosphine) ruthenium
$C_{38}H_{43}Cl_2NOP_2RuS$; FW: 795.75; black brown solid
air sensitive
Note: Patents: US20170088571A1; U.S. Provisional Patent Application No. 62/827,627.



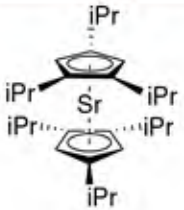
100mg

Technical Note:
1. See 44-3210 (page 93)

STRONTIUM (Compounds)

38-1200 NEW

Bis(tri-isopropylcyclopentadienyl)strontium 98%
(147658-82-0)
$[(C_3H_7)_3C_5H_2]_2Sr$; FW: 470.29; yellow liq.
air sensitive, moisture sensitive



500mg
2g

Technical Note:
1. Homoleptic strontium Cp precursor for ALD of Sr containing chalcogenide thin films.

STRONTIUM (Compounds)

38-1200 Bis(tri-isopropylcyclopentadienyl)strontium 98% *(147658-82-0)*
(continued)

Target Deposit	Deposition Technique	Delivery Temperature	Pressure	Co-reactants	Deposition Temperature	Ref.
SrO	ALD	100 °C	7.5 Torr	H_2O	250 °C	[1]
SrO	ALD	140-145 °C	1 Torr	H_2O	150-390 °C	[7]
$SrTiO_3$	ALD	100 °C	7.5 Torr	H_2O, $Ti(O^iPr)_4$	250-325 °C	[1]
$SrTiO_3$	ALD	150 °C	0.2 Torr	H_2O, $Ti(NMe_2)_4$	120-330 °C	[10]
$SrTiO_3$	ALD	90 °C	0.7 Torr	O_3, H_2O, $Ti(Me_2Cp)(OMe)_3$	370 °C	[8]
$SrTiO_3$	ALD	90 °C	0.7 Torr	O_3, H_2O, $Ti(O^iPr)_2(tmhd)_2$	370 °C	[8]
$SrTiO_3$	ALD	130 °C		O_3, $Ti(NEtMe)_4$	300 °C	[4]
$SrTiO_3$	PEALD	120 °C		O_2 plasma, $Ti(O^iPr)_2(tmhd)_2$	250 °C	[5]
$La_xSr_{1-x}TiO_3$	ALD	130 °C	1 Torr	H_2O, $Ti(O^iPr)_4$, $La(fmd)_3$	225 °C	[9]
$SrSnO_3$	ALD	130 °C	1 Torr	$Sn(NMe_2)_4$, H_2O	180 °C	[12]
$SrZrO_3$	ALD	130 °C	1 Torr	H_2O, $Zr(NMe_2)_4$	225 °C	[11]
$SrRuO_3$	CVD/ALD			O_2, RuO_4	230 °C	[6]
SrS	ALD	100 °C	7.5 Torr	H_2S	120-460 °C	[2]
M:SrS (M=Cu, Pb, Ce, Mn, Eu)	ALD	100 °C	7.5 Torr	H_2S, $Cu(Cp)(PEt_3)$, $Pb(^tBu_3Cp)_2$, $Ce(Cp)_3$, $Mn(thmd)_3$, $Eu(thmd)_3$	120-380 °C	[3]

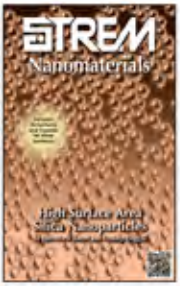
Thermal Behavior

- TGA available in [2]
- Decomposition in process ~250 °C [1, 7]
- Vapor pressure ~0.5 Torr at 120 °C [5]

References:

1. *Chem. Vap. Deposition* **2001**, *7*, 75.
2. *Chem. Mater.* **2002**, *14*, 1937.
3. *J. Electrochem. Soc.* **2004**, *151*, H221.
4. *J. Appl. Phys.* **2011**, *109*, 094101.
5. *J. Electrochem. Soc.* **2011**, *158*, G34.
6. *Chem. Mater.* **2013**, *25*, 953.
7. *J. Phys. Chem. C* **2013**, *117*, 11578.
8. *ECS Trans.* **2013**, *58*, 171.
9. *J. Appl. Phys.* **2014**, *115*, 224108.
10. *Thin Solid Films* **2014**, *550*, 53.
11. *J. Appl. Phys.* **2018**, *124*, 044102.
12. *J. Vac. Sci. Technol. A*, **2019**, *37*, 050902.

Available Booklets



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