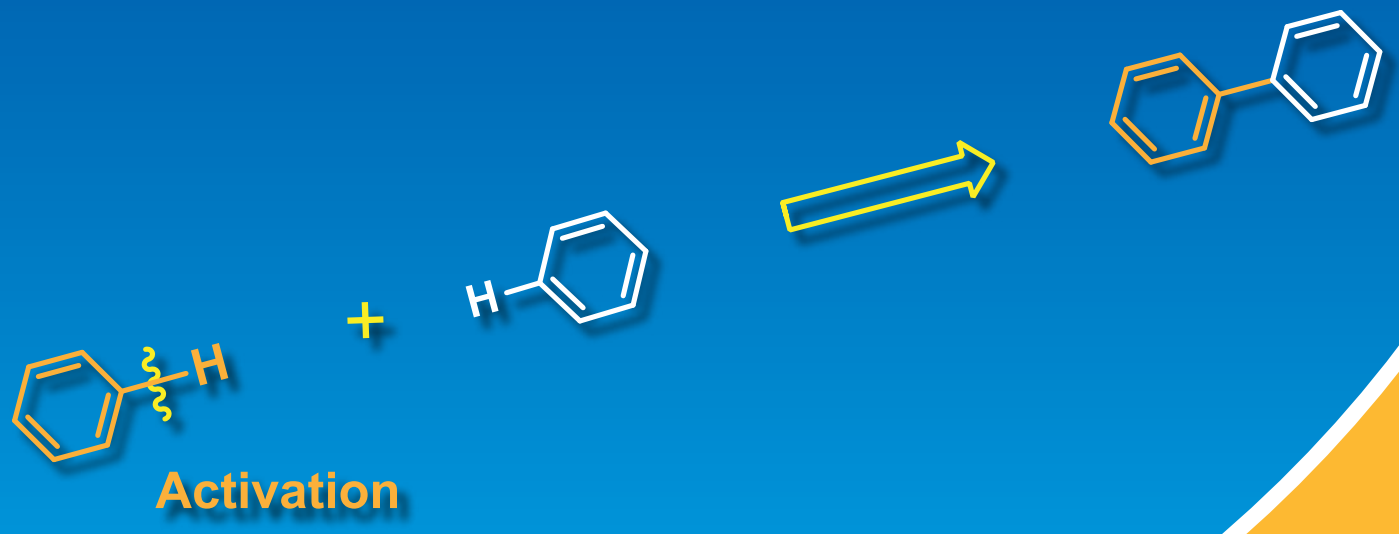
CHEMISTRY

C-H Bond Activation Reaction



Metal Catalysts

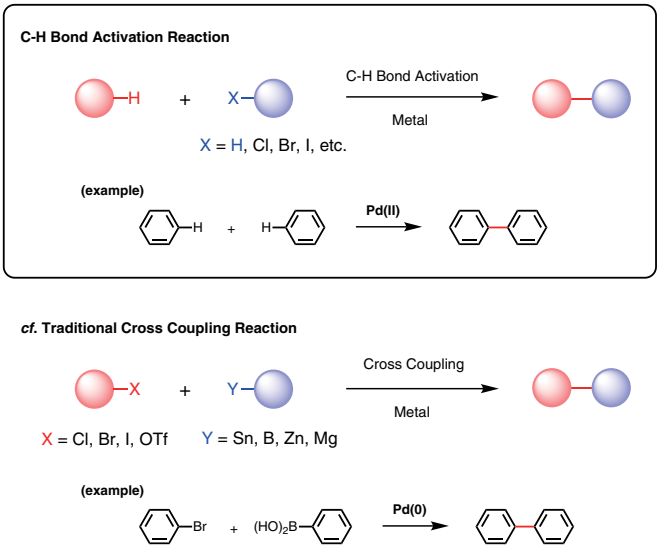
Ligands

Directing Group Introducing Agents

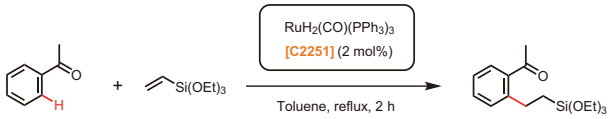
Additives

C-H Bond Activation Reaction

Recently, there have been a large number of reports on “C-H bond activation reaction”. C-H bond activation is a methodology for directly forming carbon-carbon bonds by activating a carbon-hydrogen bond, which is the most fundamental linkage in organic chemistry. Traditional cross coupling reactions have been one of the most useful synthetic methods for the formation of carbon-carbon bonds. However, the cross coupling reaction requires extra procedures for preparing organic halides (or triflates) compounds, and organic boron or metal compounds. On the other hand, the C-H bond activation can reduce these procedures, thus making this reaction a cost-effective and eco-friendly system.



C-H bonds generally have relatively high energy; therefore, the formation of a carbon-carbon or carbon-heteroatom bond by dissecting C-H bonds has been believed to be difficult. In 1993, Murai *et al*. reported the direct addition of C-H bonds of aromatic ketones to olefins in the presence of a catalytic amount of carbonyl(dihydrido)tris(triphenylphosphine)ruthenium(II) **[C2251]**.[1] Since then, numerous examples of C-H bond activation have been reported.



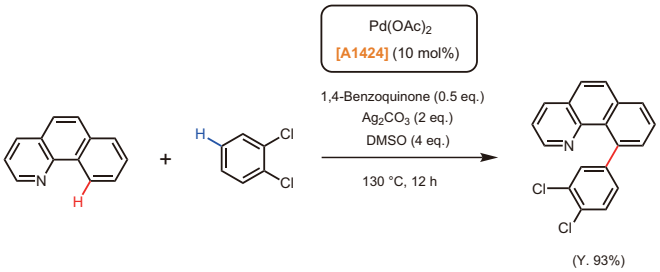
The reaction above proceeds without using halogenated compounds and organic boron or organic metal compounds. Thus, this system is cost-effective and eco-friendly.

In general, palladium(II), rhodium(I), iridium(I), ruthenium(II), copper(II), and iron(II) are widely used in C-H bond activation. There are a number of reports on C-H bond activation using these catalysts in the presence of appropriate ligands and activating reagents. In this brochure, some examples of C-H bond activation using palladium catalysts, iridium catalysts, and iron catalysts are shown as below.

● Pd(II) Catalysts

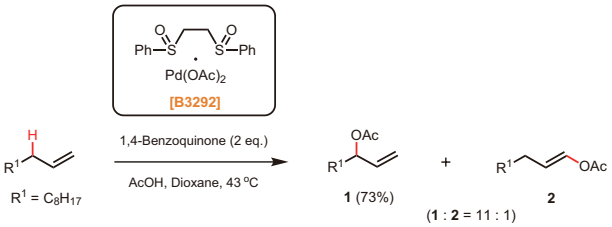
1. Regio-selective Coupling Reaction of 7,8-Benzoquinoline and Arene Compounds

Sanford *et al*. have reported the direct coupling reaction of 7,8-benzoquinoline and arene compounds using palladium acetate(II) **[A1424]**.[2] In this reaction, a nitrogen atom of 7,8-benzoquinoline functions as a directing group to allow it to selectively introduce arenes at the C-10 position. Moreover, arene compounds also react with 7,8-benzoquinoline at the least sterically hindered positions. In this reaction system, 1,4-benzoquinone functions as a reaction promoter, and silver(I) carbonate oxidizes the generated Pd(0) species, which forms the Pd(II) / Pd(0) catalytic cycle.

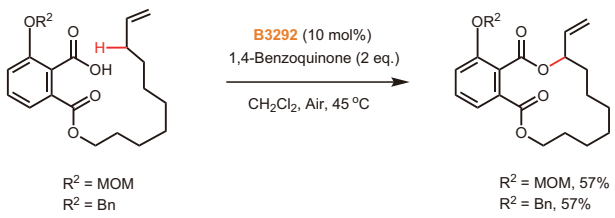


2. Allylic C-H Oxidation using “White Catalyst”

1,2-Bis(phenylsulfinyl)ethane palladium(II) diacetate **[B3292]** is a palladium catalyst, which was developed by M. C. White *et al.,* and named “White catalyst” after the developer. For an example of its characteristic reactivity differing from other homogeneous palladium catalysts, the allylic C-H oxidation reaction has been reported, in which an acetoxy group is introduced regioselectively into the allylic position.[3]

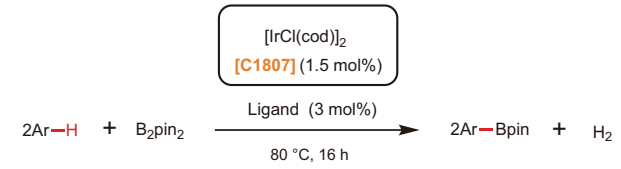


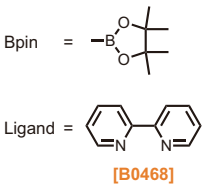
Moreover, White *et al.* have also reported the macrolactonization reaction of ortho-substituted salicylic acid substrates, applying the reaction into intramolecular allylic C-H oxidation, in which the corresponding 14-membered ring macrolides are obtained in moderate yields.[4]

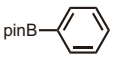
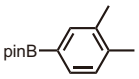
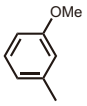
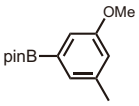


Ir(I) Catalyst

Miyaura, Ishiyama and Hargwig *et al.* have reported the direct C-H borylation in 2002.[5] This reaction is the most famous and practical example of C-H bond activation using iridium catalysts. Aryl borates had been synthesized by the reaction of aryl lithium or magnesium reagents with trialkyl borates so far, however, their method allowed a one-step preparation of alkyl borates in a simple manner.



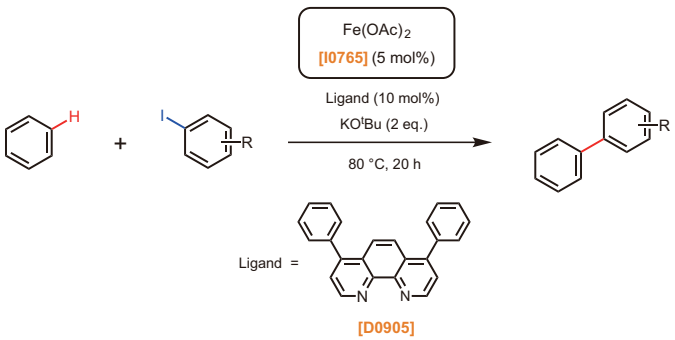


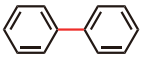
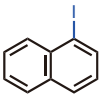
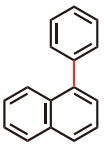
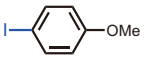
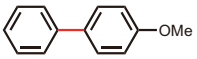
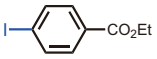
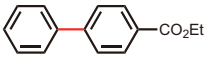
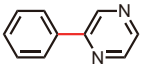
Arene	Product (Y. %)
	 (95%)
	 (83%)
	 (72%)

Fe(II) Catalyst

Including palladium catalysts, which are frequently used for the Suzuki-Miyaura coupling reaction, transition metal catalysts, such as nickel or platinum, have been widely used for organic synthesis. However, the percentages of these metals in the earth's crust are extremely small, and their prices are rather expensive.[6] On the other hand, iron is abundant and less expensive, and therefore, more and more chemists have focused their attention to organic synthesis using iron compounds as a catalyst. Cross coupling reactions using iron catalysts have been reported.[7]

For an example of C-H activation using iron catalysts, Charette *et al.* have reported the direct coupling reaction of benzene with aryl iodides using iron(II) acetate **[I0765]**.[8] This reaction is highly cost-effective and environmentally friendly in the sense of using an iron catalyst, which is less expensive, and therefore, further development and applications are expected from the point of green chemistry.



Aryl Iodide	Product (Y. %)
	 (89%)
	 (60%)
	 (93%)
	 (40%)
	 (79%)

Thus, C-H bond activation has been widely studied as a new methodology of carbon-carbon and carbon-heteroatom bond formations, following a cross coupling reaction and olefin metathesis.

TCI offers a variety of transition metal catalysts, ligands, and activating reagents readily available for C-H bond activation as below.

References

1) S. Murai, F. Kakiuchi, S. Sekine, Y. Tanaka, A. Kamatani, M. Sonoda, N. Chatani, *Nature* **1993,** *366*, 529.
2) K. L. Hull, M. S. Sanford, *J. Am. Chem. Soc.* **2007**, *129*, 11904.
3) M. S. Chen, N. Prabagaran, N. A. Labenz, M. C. White, *J. Am. Chem. Soc.* **2005**, *127*, 6970.
4) K. J. Fraunhoffer, N. Prabagaran, L. E. Sirois, M. C. White, *J. Am. Chem. Soc.* **2006**, *128*, 9032.
5) T. Ishiyama, J. Takagi, K. Ishida, N. Miyaura, N. R. Anastasi, J. F. Hartwig, *J. Am. Chem. Soc.* **2002**, *124*, 390.
6) J. Emsley, in *The Elements*, 3rd ed., Oxford Univ. Press, New York, **1998**.
7) T. Nagano, T. Hayashi, *Org. Lett.* **2004**, *6*, 1297; K. G. Dongo, H. Koh, M. Sau, C. L. L. Chai, *Adv. Synth. Catal.* **2007**, *349*, 1015; T. Hatakeyama, M. Nakamura, *J. Am. Chem. Soc.* **2007**, *129*, 9844.
8) F. Vallée, J. J. Mousseau, A. B. Charette, *J. Am. Chem. Soc.* **2010**, *132*, 1514,

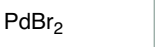
Metal Catalysts

Palladium Catalysts

P1489 1g 5g

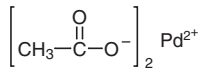
Palladium(II) Chloride
CAS RN: 7647-10-1

P1937 2g



Palladium(II) Bromide
CAS RN: 13444-94-5

A1424 1g 5g



Palladium(II) Acetate
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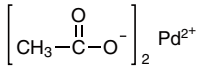
P2161 1g



Palladium(II) Acetate(Purified)
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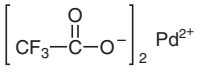
P1870 1g 5g



Palladium(II) Trifluoroacetate
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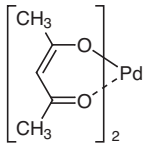
B2018 1g 5g



Palladium(II) Acetylacetonate
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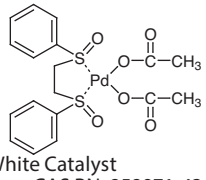
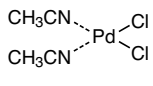
B3292 200mg 1g



White Catalyst
CAS RN: 858971-43-4

B1676 1g 5g



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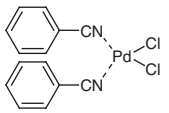
B1668 1g 5g



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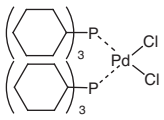
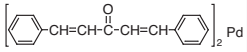
B2055 1g 5g



Bis(tricyclohexylphosphine)-palladium(II) Dichloride
CAS RN: 29934-17-6

B1374 1g 5g



Bis(dibenzylideneacetone)-palladium(0)
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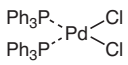
B1667 1g 5g 25g



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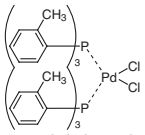
CAS RN: 13965-03-2

B2026 1g 5g



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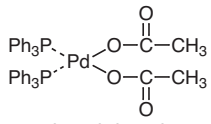
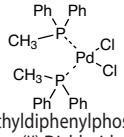
B2042 1g 5g



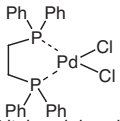
Bis(triphenylphosphine)-palladium(II) Diacetate
CAS RN: 14588-08-0

B2161 1g



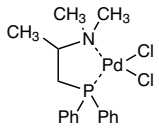
Bis(methyldiphenylphosphine)-palladium(II) Dichloride
(*cis*- and *trans*- mixture)
CAS RN: 52611-08-2

B2016 1g 5g



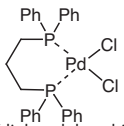
[1,2-Bis(diphenylphosphino)-ethane]palladium(II) Dichloride
CAS RN: 19978-61-1

D5719 250mg



$PdCl_2$(alaphos)
CAS RN: 85719-56-8

B2192 1g 5g



[1,3-Bis(diphenylphosphino)-propane]palladium(II) Dichloride
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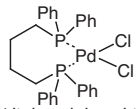
B2031 1g 5g



[1,4-Bis(diphenylphosphino)-butane]palladium(II) Dichloride
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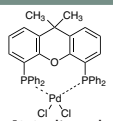
D4333 200mg 1g



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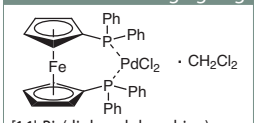
B2064 1g 5g 25g



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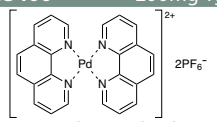
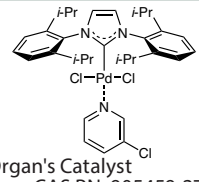
B5400 200mg 1g



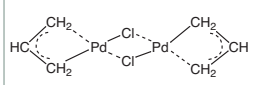
Bis(1,10-phenanthroline)-palladium(II) Bis(hexafluorophosphate)
CAS RN: 113173-22-1

B6199 1g 5g 25g



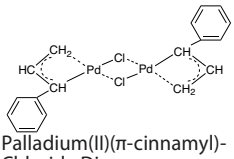
Organ's Catalyst
CAS RN: 905459-27-0

A1479 500mg 1g



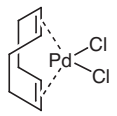
Allylpalladium(II) Chloride Dimer
CAS RN: 12012-95-2

P2017 200mg



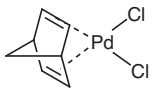
Palladium(II)(π-cinnamyl)-Chloride Dimer
CAS RN: 12131-44-1

D2604 1g 5g



Dichloro(1,5-cyclooctadiene)-palladium(II)
CAS RN: 12107-56-1

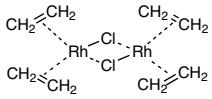
N0842 1g



2,5-Norbornadiene Palladium(II) Dichloride
CAS RN: 12317-46-3

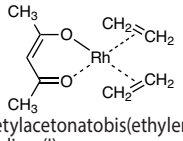
Rhodium Catalysts

C2461 200mg



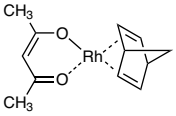
Chlorobis(ethylene)-rhodium(I) Dimer
CAS RN: 12081-16-2

A2100 200mg



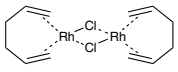
Acetylacetonatobis(ethylene)-rhodium(I)
CAS RN: 12082-47-2

A2761 200mg 1g



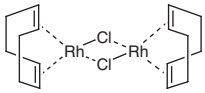
(Acetylacetonato)-(norbornadiene)rhodium(I)
CAS RN: 32354-50-0

C3194 100mg



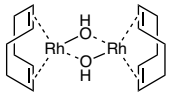
Chloro(1,5-hexadiene)-rhodium(I) Dimer
CAS RN: 32965-49-4

B1045 100mg 1g



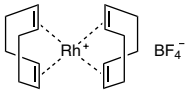
Chloro(1,5-cyclooctadiene)-rhodium(I) Dimer
CAS RN: 12092-47-6

H1562 200mg 1g



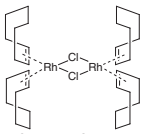
Hydroxy(1,5-cyclooctadiene)-rhodium(I) Dimer
CAS RN: 73468-85-6

B3961 100mg 1g



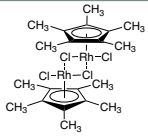
Bis(1,5-cyclooctadiene)-rhodium(I) Tetrafluoroborate
CAS RN: 35138-22-8

C2253 100mg 500mg



Chlorobis(cyclooctene)-rhodium(I) Dimer
CAS RN: 12279-09-3

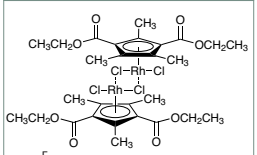
P1788 200mg 1g



(Pentamethylcyclopentadienyl)-rhodium(III) Dichloride Dimer
CAS RN: 12354-85-7

Please inquire for pricing and availability of listed products to our local sales representatives.

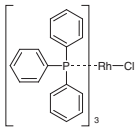
B6169 200mg



$[Cp^{E}RhCl_2]_2$

CAS RN: 1352745-18-6

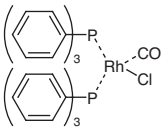
T0931 1g



Tris(triphenylphosphine)rhodium(I) Chloride

CAS RN: 14694-95-2

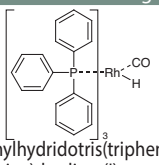
B1692 1g



Carbonylbis(triphenylphosphine)-rhodium(I) Chloride

CAS RN: 13938-94-8

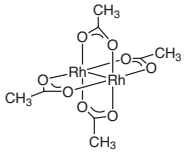
C1383 1g 5g



Carbonylhydridotris(triphenyl-phosphine)rhodium(I)

CAS RN: 17185-29-4

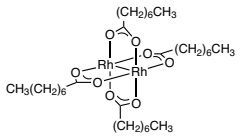
R0069 100mg 1g



Rhodium(II) Acetate Dimer

CAS RN: 15956-28-2

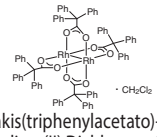
R0161 200mg 1g



Rhodium(II) Octanoate Dimer

CAS RN: 73482-96-9

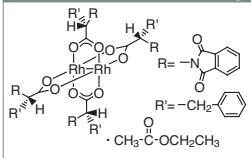
T1544 100mg



Tetrakis(triphenylacetato)-dirhodium(II) Dichloromethane Adduct

CAS RN: 142214-04-8

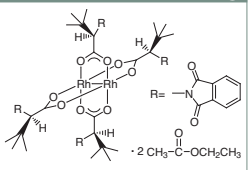
T1551 100mg



Rh_2(*S*-PTPA)$_4$ EtOAc

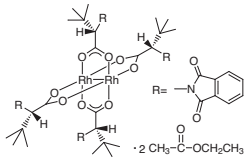
CAS RN: 131219-55-1

T2054 100mg



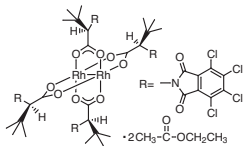
Rh_2(*R*-PTTL)$_4$ 2EtOAc

T2055 100mg



Rh_2(*S*-PTTL)$_4$ 2EtOAc

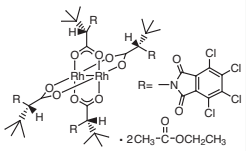
T2658 50mg



Rh_2(*R*-TCPTTL)$_4$ 2EtOAc

CAS RN: 2001054-66-4

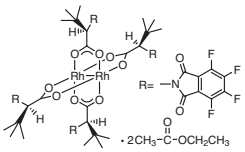
T2659 100mg



Rh_2(*S*-TCPTTL)$_4$ 2EtOAc

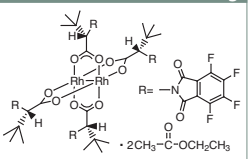
CAS RN: 1816286-21-1

T2660 50mg



Rh_2(*R*-TFPTTL)$_4$ 2EtOAc

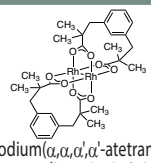
T2661 100mg



Rh_2(*S*-TFPTTL)$_4$ 2EtOAc

CAS RN: 2635339-90-9

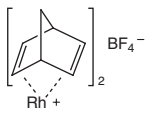
B4549 100mg



Bis[rhodium(α,α,α',α'-atetramethyl-1,3-benzenedipropionic Acid)]

CAS RN: 819050-89-0

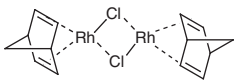
B2091 100mg



Bis[η-(2,5-norbornadiene)]-rhodium(I) Tetrafluoroborate

CAS RN: 36620-11-8

N0453 100mg



Norbornadiene Rhodium(I) Chloride Dimer

CAS RN: 12257-42-0

Iridium Catalysts

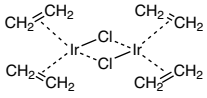
I0616 1g 5g

$IrCl_3 \cdot xH_2O$

Iridium(III) Chloride Hydrate

CAS RN: 14996-61-3

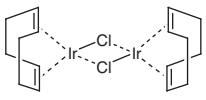
C3041 100mg



Chlorobis(ethylene)iridium(I) Dimer

CAS RN: 39722-81-1

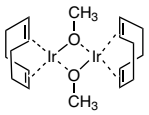
C1807 250mg 1g



Chloro(1,5-cyclooctadiene)-iridium(I) Dimer

CAS RN: 12112-67-3

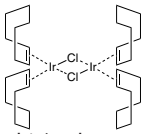
C2662 200mg 1g



(1,5-Cyclooctadiene)(methoxy)-iridium(I) Dimer

CAS RN: 12148-71-9

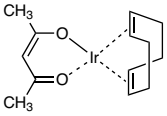
C2985 200mg



Chlorobis(cyclooctene)-iridium(I) Dimer

CAS RN: 12246-51-4

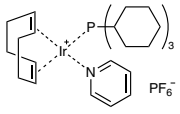
A2981 200mg 1g



(Acetylacetonato)-(1,5-cyclooctadiene)iridium(I)

CAS RN: 12154-84-6

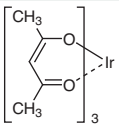
C2824 100mg



Crabtree's Catalyst

CAS RN: 64536-78-3

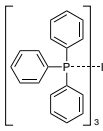
T2557 1g



Tris(2,4-pentanedionato)-iridium(III)

CAS RN: 15635-87-7

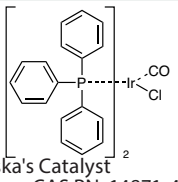
C3040 200mg 1g



Carbonylhydrido-tris(triphenylphosphine)iridium(I)

CAS RN: 17250-25-8

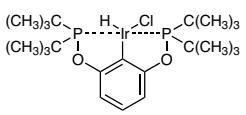
C2252 200mg 1g



Vaska's Catalyst

CAS RN: 14871-41-1

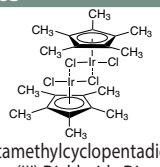
B5033 200mg



2,6-Bis(di-tert-butylphosphinoxy)-phenylchlorohydroiridium(III)

CAS RN: 671789-61-0

P1763 1g



(Pentamethylcyclopentadienyl)-iridium(III) Dichloride Dimer

CAS RN: 12354-84-6

Ruthenium Catalysts

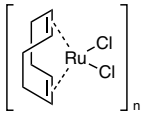
R0074 1g 5g

$RuCl_3 \cdot xH_2O$

Ruthenium(III) Chloride Hydrate

CAS RN: 14898-67-0

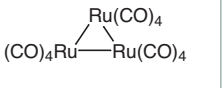
D4792 1g 5g



$[RuCl_2(COD)]n$

CAS RN: 50982-12-2

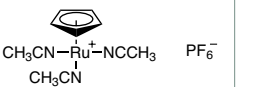
T2181 100mg 1g



Triruthenium Dodecacarbonyl

CAS RN: 15243-33-1

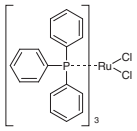
T3079 200mg



Tris(acetonitrile)-cyclopentadienylruthenium(II) Hexafluorophosphate

CAS RN: 80049-61-2

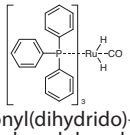
D1997 1g 5g



Tris(triphenylphosphine)-ruthenium(II) Dichloride

CAS RN: 15529-49-4

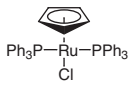
C2251 250mg 1g



Carbonyl(dihydrido)-tris(triphenylphosphine)-ruthenium(II)

CAS RN: 25360-32-1

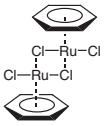
C2201 1g 5g



Cyclopentadienyl-bis(triphenylphosphine)-ruthenium(II) Chloride

CAS RN: 32993-05-8

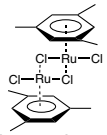
B1902 1g 5g



Benzeneruthenium(II) Chloride Dimer

CAS RN: 37366-09-9

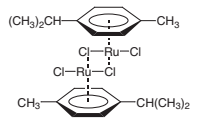
D5524 250mg 1g



Mesityleneruthenium(II) Chloride Dimer

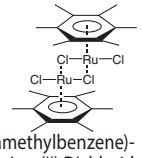
CAS RN: 52462-31-4

D2751 1g 5g



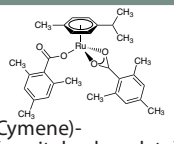
Dichloro(*p*-cymene)ruthenium(II) Dimer
CAS RN: 52462-29-0

H1010 1g



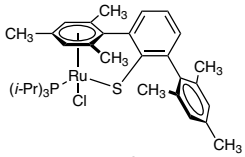
(Hexamethylbenzene)-ruthenium(II) Dichloride Dimer
CAS RN: 67421-02-7

C3456 500mg



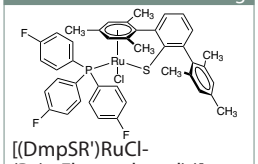
(*p*-Cymene)-bis(mesitylcarboxylato)-ruthenium(II)
CAS RN: 1251667-99-8

C3327 100mg



[(DmpSR')RuCl(P-(*i*-Pr)$_3$)]
CAS RN: 1621182-04-4

C3328 100mg



[(DmpSR')RuCl-(P-(4-Fluorophenyl)$_3$)]
CAS RN: 1420299-84-8

Nickel Catalysts

N0850 25g 500g

$NiCl_2$

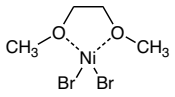
Nickel(II) Chloride Anhydrous
CAS RN: 7718-54-9

N0851 25g 500g

$NiCl_2 \cdot 6H_2O$

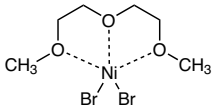
Nickel(II) Chloride Hexahydrate
CAS RN: 7791-20-0

N1050 1g 10g



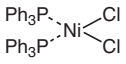
NiBr (dme)
CAS RN: 28923-39-9

N1049 1g 10g



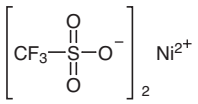
Nickel(II) Bromide 2-Methoxyethyl Ether Complex
CAS RN: 312696-09-6

B1571 10g 100g



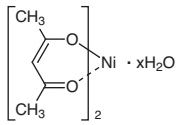
Bis(triphenylphosphine)-nickel(II) Dichloride
CAS RN: 14264-16-5

N0861 1g 5g



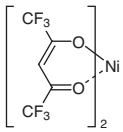
Nickel(II) Triflate
CAS RN: 60871-84-3

N0096 25g 100g 500g



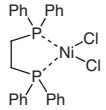
Bis(2,4-pentanedionato)-nickel(II) Hydrate
CAS RN: 120156-44-7

H0558 1g 5g



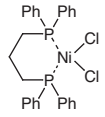
Bis(hexafluoroacetylacetonato)-nickel(II)
CAS RN: 14949-69-0

B2225 1g 5g 25g



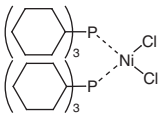
[1,2-Bis(diphenylphosphino)-ethane]nickel(II) Dichloride
CAS RN: 14647-23-5

B1313 5g 25g



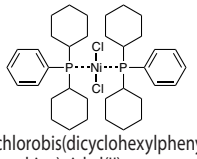
[1,3-Bis(diphenylphosphino)-propane]dichloronickel(II)
CAS RN: 15629-92-2

B3534 1g 5g



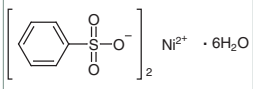
Bis(tricyclohexylphosphine)-nickel(II) Dichloride
CAS RN: 19999-87-2

D5369 250mg



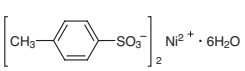
Dichlorobis(dicyclohexylphenyl-phosphine)nickel(II)
CAS RN: 19232-03-2

B0034 25g



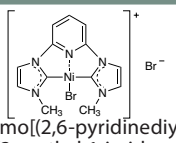
Nickel(II) Benzenesulfonate Hexahydrate
CAS RN: 39819-65-3

T0276 5g 25g



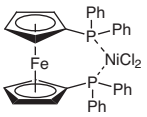
Nickel(II) *p*-Toluenesulfonate Hexahydrate
CAS RN: 6944-05-4

B3354 1g



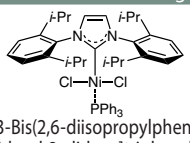
Bromo[(2,6-pyridinediyl)-bis(3-methyl-1-imidazolyl-2-ylidene)]nickel Bromide
CAS RN: 894102-11-5

B2226 1g 5g



[1,1'-Bis(diphenylphosphino)-ferrocene]nickel(II) Dichloride
CAS RN: 67292-34-6

B3235 200mg 1g



[1,3-Bis(2,6-diisopropylphenyl)-imidazol-2-ylidene]triphenyl-phosphine Nickel(II) Dichloride
CAS RN: 903592-98-3

Cobalt Catalysts

C3863 50g 250g

$CoCl_2$

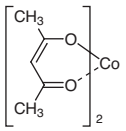
Cobalt(II) Chloride
CAS RN: 7646-79-9

C2388 250g

$CoCl_2 \cdot 6H_2O$

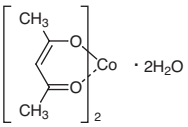
Cobalt(II) Chloride Hexahydrate
CAS RN: 7791-13-1

B2681 25g



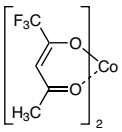
Acetylacetone Cobalt(II) Salt
CAS RN: 14024-48-7

C0373 25g 500g



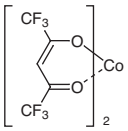
Bis(2,4-pentanedionato)-cobalt(II) Dihydrate
CAS RN: 123334-29-2

T0746 1g 5g



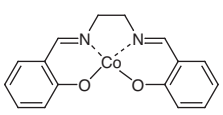
Bis(trifluoro-2,4-pentanedionato)cobalt(II)
CAS RN: 16092-38-9

H0553 5g



Bis(hexafluoroacetylacetonato)-cobalt(II)
CAS RN: 19648-83-0

S0318 25g 100g 500g

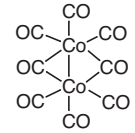


Salcomine
CAS RN: 14167-18-1

D4940 2g

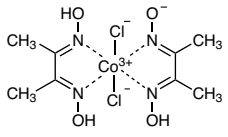
Dicarbonyl-cyclopentadienylcobalt(I)
CAS RN: 12078-25-0

D3213 5g 25g



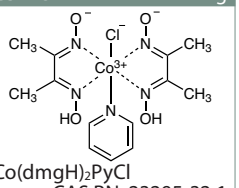
Dicobalt Octacarbonyl
(stabilized with 1-5% Hexane)
CAS RN: 10210-68-1

D5924 1g 5g



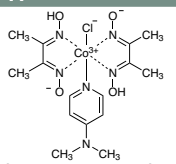
$Co(dmgH)_2Cl_2$
CAS RN: 23638-66-6

C3718 1g



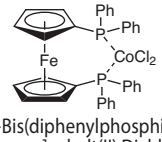
$Co(dmgH)_2PyCl$
CAS RN: 23295-32-1

C3711 1g



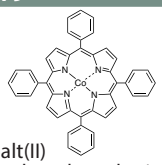
$Co(dmgH)_2(DMAP)Cl$
CAS RN: 483979-48-2

B3374 1g 5g



[1,1'-Bis(diphenylphosphino)-ferrocene]cobalt(II) Dichloride
CAS RN: 67292-36-8

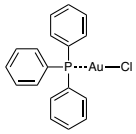
C3579 1g



Cobalt(II) Tetraphenylporphyrin
CAS RN: 14172-90-8

Gold Catalysts

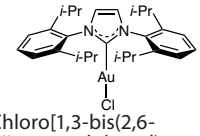
T2994 200mg 1g



(Triphenylphosvphine)-gold(I) Chloride
CAS RN: 14243-64-2

Please inquire for pricing and availability of listed products to our local sales representatives.

C2405 200mg



Chloro[1,3-bis(2,6-diisopropylphenyl)-imidazol-2-ylidene]gold(I)
CAS RN: 852445-83-1

Silver Catalysts

I1183 5g 25g

$AgCl$

Silver(I) Chloride
CAS RN: 7783-90-6

S0463 5g 25g

$AgSbF_6$

Silver Hexafluoroantimonate(V)
CAS RN: 26042-64-8

S0981 1g 5g

$AgPF_6$

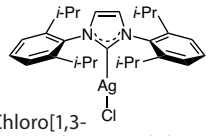
Silver Hexafluorophosphate
CAS RN: 26042-63-7

S0898 1g 5g

$Ag^+ \ (CF_3SO_2)_2N^-$

Silver Triflimide
CAS RN: 189114-61-2

C2373 200mg 1g



Chloro[1,3-bis(2,6-diisopropylphenyl)-imidazol-2-ylidene]silver
CAS RN: 873297-19-9

Copper Catalysts

T2666 1g 5g 25g

$(CH_3CN)_4Cu^+ \ BF_4^-$

Tetrakis(acetonitrile)copper(I) Tetrafluoroborate
CAS RN: 15418-29-8

T2665 5g

$(CH_3CN)_4Cu^+ \ PF_6^-$

Tetrakis(acetonitrile)copper(I) Hexafluorophosphate
CAS RN: 64443-05-6

T3905 1g 5g

$(CH_3CN)_4Cu^+ \ CF_3SO_3^-$

Tetrakis(acetonitrile)copper(I) Triflate
CAS RN: 58452-28-1

C1952 25g 300g

$CuCN$

Copper(I) Cyanide
CAS RN: 544-92-3

C2162 25g 100g 500g

$CuCl$

Copper(I) Chloride
CAS RN: 7758-89-6

C3714 25g 500g

$CuCl_2$

Copper(II) Chloride Anhydrous
CAS RN: 7447-39-4

C2161 25g 100g 500g

$CuBr$

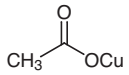
Copper(I) Bromide
CAS RN: 7787-70-4

C2163 25g 100g 500g

CuI

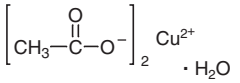
Copper(I) Iodide
CAS RN: 7681-65-4

A1540 5g 25g



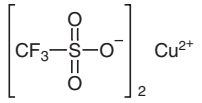
Copper(I) Acetate
CAS RN: 598-54-9

C2346 25g 500g



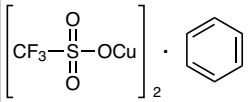
Copper(II) Acetate Monohydrate
CAS RN: 6046-93-1

T1292 5g 25g



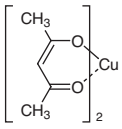
Copper(II) Trifluoromethanesulfonate
CAS RN: 34946-82-2

T1442 1g 5g



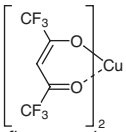
Copper(I) Triflate Benzene Complex
CAS RN: 42152-46-5

C0384 25g 250g



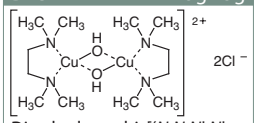
Bis(2,4-pentanedionato)-copper(II)
CAS RN: 13395-16-9

H0554 1g 5g



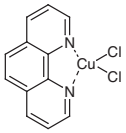
Bis(hexafluoroacetylacetonato)-copper(II)
CAS RN: 14781-45-4

D2542 5g 25g



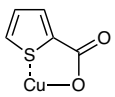
Di-μ-hydroxo-bis[(*N*,*N*,*N*',*N*'-tetramethylethylenediamine)-copper(II)] Chloride
CAS RN: 30698-64-7

D3891 1g 5g



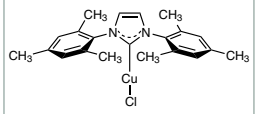
Dichloro(1,10-phenanthroline)copper(II)
CAS RN: 14783-09-6

C2312 1g 5g



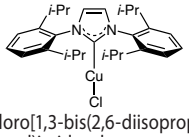
CuTC
CAS RN: 68986-76-5

C2422 200mg 1g



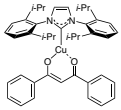
Chloro(1,3-dimesitylimidazol-2-ylidene)copper(I)
CAS RN: 873779-78-3

C2304 200mg 1g



Chloro[1,3-bis(2,6-diisopropyl-phenyl)imidazol-2-ylidene]copper(I)
CAS RN: 578743-87-0

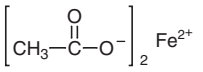
B3351 200mg 1g



[1,3-Bis(2,6-diisopropylphenyl)-imidazol-2-ylidene](1,3-diphenyl-1,3-propanedionato)copper(I)
CAS RN: 920739-11-3

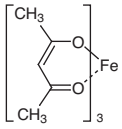
Iron Catalysts

I0765 5g 25g



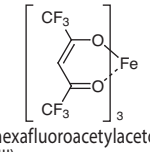
Iron(II) Acetate
CAS RN: 3094-87-9

I0079 25g 100g 500g



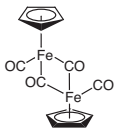
Iron(III) Acetylacetonate
CAS RN: 14024-18-1

H0555 1g



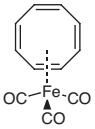
Tris(hexafluoroacetylacetonato)-iron(III)
CAS RN: 17786-67-3

C1592 5g



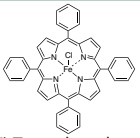
Cyclopentadienyliron Dicarbonyl Dimer
CAS RN: 12154-95-9

T1775 1g



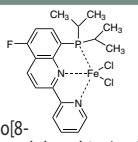
Tricarbonyl(cyclooctatetraene)-iron
CAS RN: 12093-05-9

I0937 200mg 1g



Iron(III) Tetraphenylporphyrin Chloride
CAS RN: 16456-81-8

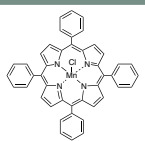
D5886 100mg



Dichloro[8-(diisopropylphosphino)-5-fluoro-2-(2-pyridinyl)quinoline]iron(II)
CAS RN: 2247605-87-2

Manganese Catalysts

M2621 1g 5g



Manganese(III) Tetraphenylporphyrin Chloride
CAS RN: 32195-55-4

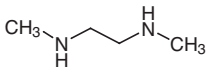
D5880 1g

$[Mn(CO)_5]_2$

Manganese Carbonyl
CAS RN: 10170-69-1

Ligands

D0720 5mL 25mL



N,N'-Dimethylethylene-diamine
CAS RN: 110-70-3

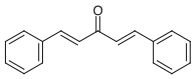
N0166 25g 400g

2-Norbornene
CAS RN: 498-66-8

N0346 25mL 100mL 500mL

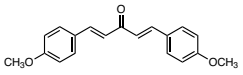
2,5-Norbornadiene
(stabilized with BHT)
CAS RN: 121-46-0

D0903 25g 250g



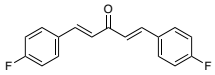
trans,trans-Dibenzylidene-acetone
CAS RN: 35225-79-7

B4467 200mg 1g



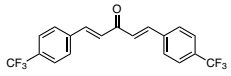
trans,trans-Bis(4-methoxy-benzylidene)acetone
CAS RN: 37951-12-5

B2283 5g



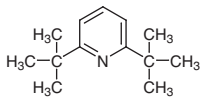
trans,trans-Bis(4-fluoro-benzylidene)acetone
CAS RN: 53369-00-9

B4468 200mg



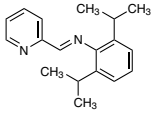
trans,trans-Bis[4-(trifluoro-methyl)benzylidene]-acetone
CAS RN: 103836-71-1

D1804 5g 25g



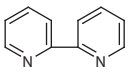
2,6-Di-*tert*-butylpyridine
CAS RN: 585-48-8

D4652 1g



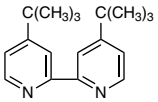
trans-2,6-Diisopropyl-*N*-(2-pyridylmethylene)aniline
CAS RN: 908294-68-8

B0468 25g 100g 500g



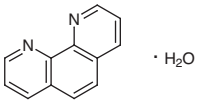
2,2'-Bipyridyl
CAS RN: 366-18-7

D3134 1g 5g



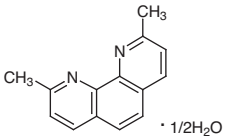
4,4'-Di-*tert*-butyl-2,2'-bipyridyl
CAS RN: 72914-19-3

P0221 1g 25g



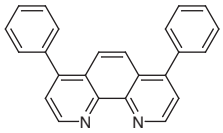
1,10-Phenanthroline
Monohydrate
CAS RN: 5144-89-8

D0771 1g



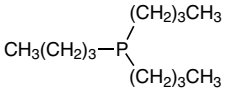
Neocuproine Hemihydrate
CAS RN: 34302-69-7

D0905 1g 5g



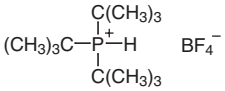
Bathophenanthroline
CAS RN: 1662-01-7

T0361 25mL 100mL 500mL



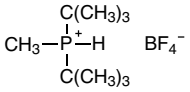
Tributylphosphine
CAS RN: 998-40-3

T2584 1g 5g



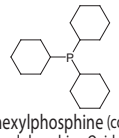
Tri-*tert*-butylphosphonium Tetrafluoroborate
CAS RN: 131274-22-1

D4731 1g 5g



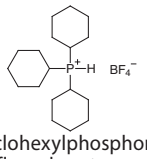
Di-*tert*-butyl(methyl)-phosphonium Tetrafluoroborate
CAS RN: 479094-62-7

T1165 25mL



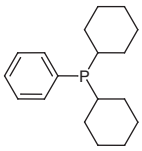
Tricyclohexylphosphine (contains Tricyclohexylphosphine Oxide) (*ca.* 18% in Toluene, *ca.* 0.60mol/L)
CAS RN: 2622-14-2

T2585 1g 5g



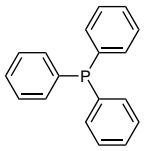
Tricyclohexylphosphonium Tetrafluoroborate
CAS RN: 58656-04-5

D2411 1g 5g



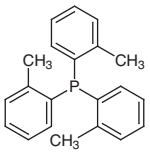
Dicyclohexylphenylphosphine
CAS RN: 6476-37-5

T0519 25g 100g 500g



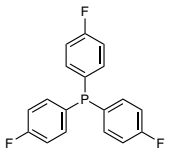
Triphenylphosphine
CAS RN: 603-35-0

T1024 5g 25g



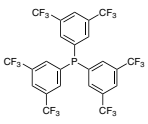
Tri(*o*-tolyl)phosphine
CAS RN: 6163-58-2

T2900 5g



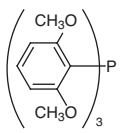
Tris(4-fluorophenyl)phosphine
CAS RN: 18437-78-0

T2526 1g 5g



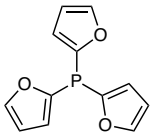
Tris[3,5-bis(trifluoromethyl)-phenyl]phosphine
CAS RN: 175136-62-6

T1614 5g 25g



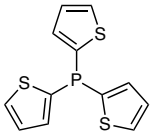
Tris(2,6-dimethoxyphenyl)phosphine
CAS RN: 85417-41-0

T1643 1g 5g



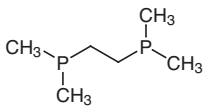
Tri(2-furyl)phosphine
CAS RN: 5518-52-5

T1666 1g 5g



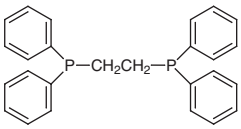
Tri(2-thienyl)phosphine
CAS RN: 24171-89-9

B1174 1g



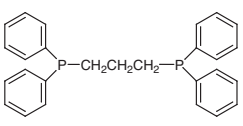
1,2-Bis(dimethylphosphino)ethane
CAS RN: 23936-60-9

B1137 10g 25g



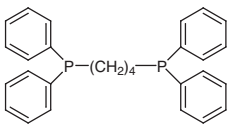
1,2-Bis(diphenylphosphino)ethane
CAS RN: 1663-45-2

B1138 5g 25g



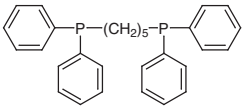
1,3-Bis(diphenylphosphino)propane
CAS RN: 6737-42-4

B1246 5g 25g



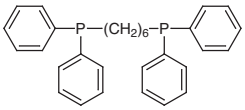
1,4-Bis(diphenylphosphino)butane
CAS RN: 7688-25-7

B1960 1g



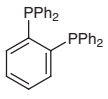
1,5-Bis(diphenylphosphino)-pentane
CAS RN: 27721-02-4

B1959 1g 5g



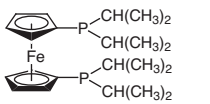
1,6-Bis(diphenylphosphino)-hexane
CAS RN: 19845-69-3

B3372 1g 5g



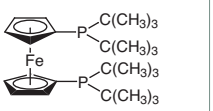
1,2-Bis(diphenylphosphino)-benzene
CAS RN: 13991-08-7

B2710 100mg 1g



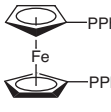
1,1'-Bis(diisopropylphosphino)-ferrocene
CAS RN: 97239-80-0

B2711 100mg 1g



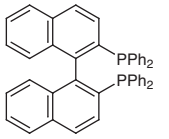
1,1'-Bis(di-*tert*-butylphosphino)-ferrocene
CAS RN: 84680-95-5

B2027 1g 5g 25g



1,1'-Bis(diphenylphosphino)-ferrocene
CAS RN: 12150-46-8

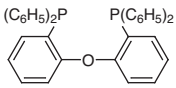
B2383 5g 25g



(+/-)-BINAP
CAS RN: 98327-87-8

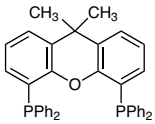
Please inquire for pricing and availability of listed products to our local sales representatives.

B2867 5g 25g



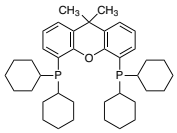
DPEphos
CAS RN: 166330-10-5

B2709 1g 5g 25g



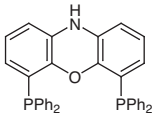
Xantphos
CAS RN: 161265-03-8

B5239 200mg 1g



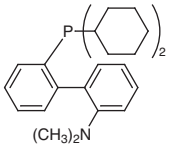
4,5-Bis(dicyclohexylphosphino)-9,9-dimethylxanthene
CAS RN: 940934-47-4

B2717 100mg 1g



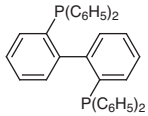
4,6-Bis(diphenylphosphino)-phenoxazine
CAS RN: 261733-18-0

D3389 1g 5g



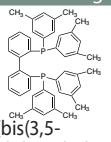
DavePhos
CAS RN: 213697-53-1

B2630 100mg 1g



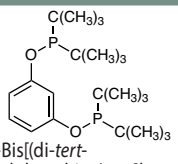
2,2'-Bis(diphenylphosphino)-biphenyl
CAS RN: 84783-64-2

B5957 100mg 500mg



2,2'-Bis[bis(3,5-dimethylphenyl)phosphino]-1,1'-biphenyl
CAS RN: 325773-62-4

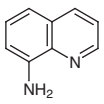
B4595 1g



1,3-Bis[(di-*tert*-butylphosphino)oxy]benzene
CAS RN: 338800-20-7

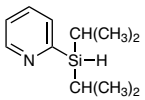
Directing Group Introducing Agents

A0419 5g 25g 100g



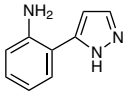
8-Aminoquinoline
CAS RN: 578-66-5

D4264 1g 5g



2-(Diisopropylsilyl)pyridine
CAS RN: 1232692-92-0

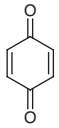
P1902 1g



2-(1*H*-Pyrazol-5-yl)aniline
CAS RN: 111562-32-4

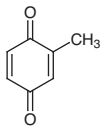
Additives

B0089 25g 100g 500g



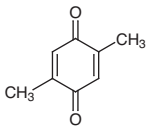
p-Benzoquinone
CAS RN: 106-51-4

T1244 25g 100g



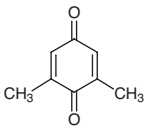
p-Toluquinone
CAS RN: 553-97-9

D0686 1g 5g 25g



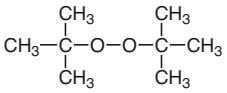
p-Xyloquinone
CAS RN: 137-18-8

D2234 1g 5g 25g



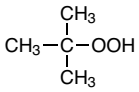
2,6-Dimethyl-1,4-benzoquinone
CAS RN: 527-61-7

D3411 100mL



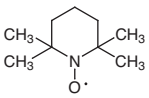
Di-*tert*-butyl Peroxide
CAS RN: 110-05-4

B3153 100g



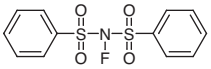
tert-Butyl Hydroperoxide
(70% in Water)
CAS RN: 75-91-2

T1560 5g 25g



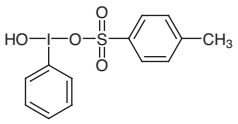
TEMPO Free Radical
CAS RN: 2564-83-2

F0335 5g 25g



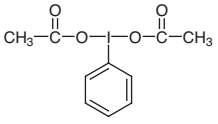
NFSI
CAS RN: 133745-75-2

P1015 5g 25g



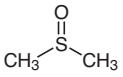
Koser Reagent
CAS RN: 27126-76-7

I0330 10g 25g 250g



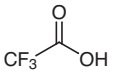
Iodobenzene Diacetate
CAS RN: 3240-34-4

D0798 25g 500g



Dimethyl Sulfoxide
CAS RN: 67-68-5

T0431 25g 100g 500g

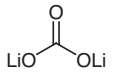


Trifluoroacetic Acid
CAS RN: 76-05-1

O0310 25g 500g

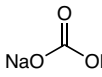
Potassium Peroxymonosulfate
CAS RN: 37222-66-5

L0224 25g 500g



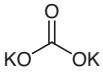
Lithium Carbonate
CAS RN: 554-13-2

S0560 300g



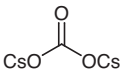
Sodium Carbonate
CAS RN: 497-19-8

P1748 300g



Potassium Carbonate
CAS RN: 584-08-7

C2160 25g 100g



Cesium Carbonate
CAS RN: 534-17-8

T2052 100mL 500mL

Titanium(IV) Chloride
(14% in Dichloromethane, *ca.* 1.0mol/L)
CAS RN: 7550-45-0

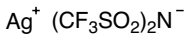
T3238 100mL 500mL

Titanium(IV) Chloride
(*ca.* 19% in Toluene, *ca.* 1.0mol/L)
CAS RN: 7550-45-0

S0463 5g 25g

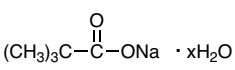
Silver Hexafluoroantimonate(V)
CAS RN: 26042-64-8

S0898 1g 5g



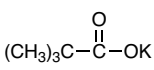
Silver Triflimide
CAS RN: 189114-61-2

S0978 5g 25g



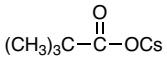
Sodium Pivalate Hydrate
CAS RN: 143174-36-1

P2354 5g 25g



Potassium Pivalate
CAS RN: 19455-23-3

C3230 1g 5g



Cesium Pivalate
CAS RN: 20442-70-0

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