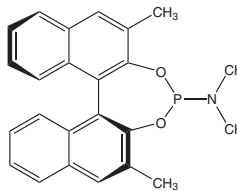
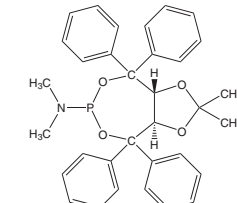
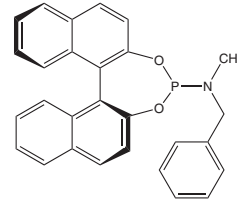
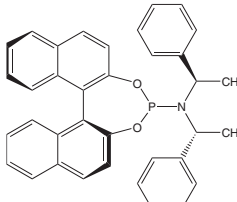
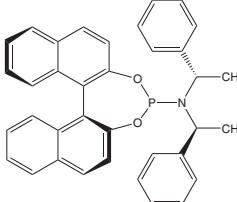
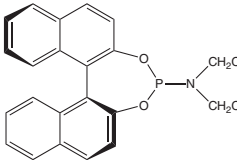
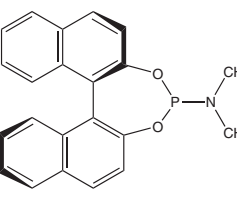
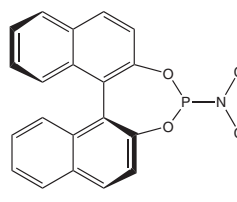
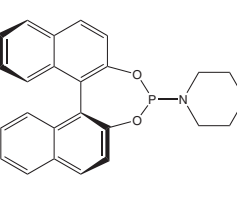
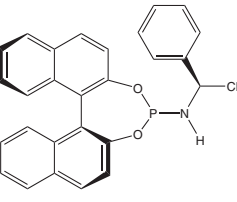
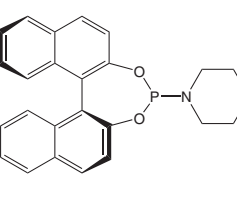
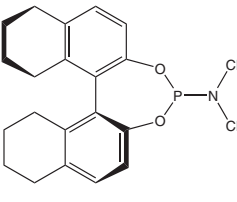


**DSM MonoPhos™ Ligand Kit:**
**For asymmetric hydrogenation and other catalytic applications**
**Catalog # 96-5650 1 kit**

<b>15-1255</b> (S)-(+)-(2,6-Dimethyl-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 98%  100mg		<b>15-1505</b> (3aR,8aR)-(-)-(2,2-Dimethyl-4,4,8,8-tetraphenyl-tetrahydro-[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphepin-6-yl)dimethylamine, min. 98%  100mg	
<b>15-1510</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)benzyl(methyl)amine, 99%  100mg		<b>15-1520</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1R)-1-phenylethyl]amine, dichloromethane adduct, min. 95%  100mg	
<b>15-1521</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1S)-1-phenylethyl]amine, min. 95%  100mg		<b>15-1231</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)diethylamine, min. 97%  250mg	
<b>15-1232</b> (R)-(-)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (R)-MONOPHOS  1g		<b>15-1233</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (S)-MONOPHOS  1g	
<b>15-1235</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)morpholine, min. 97% (S)-Morf-Phos  100mg		<b>15-1525</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)[(1R)-1-phenylethyl]amine, min. 95%  100mg	
<b>15-1234</b> (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)piperidine, min. 97% (S)-PipPhos  100mg		<b>15-3495</b> (S)-(+)-(8,9,10,11,12,13,14,15-Octahydro-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, 99%  100mg	

*Sold in collaboration with DSM for research purposes only. Patent WO 0204466.*

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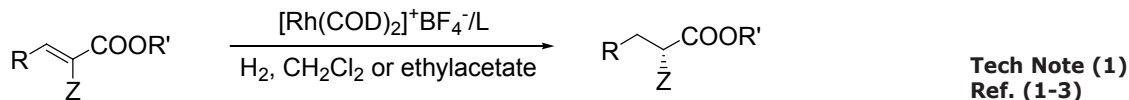
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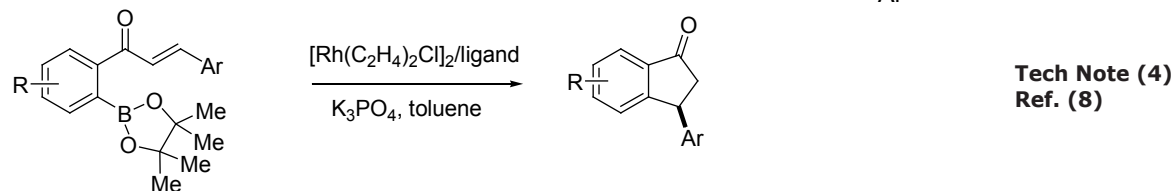
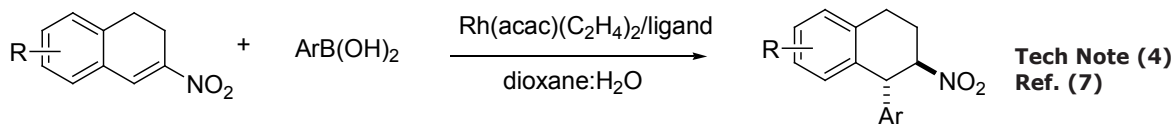
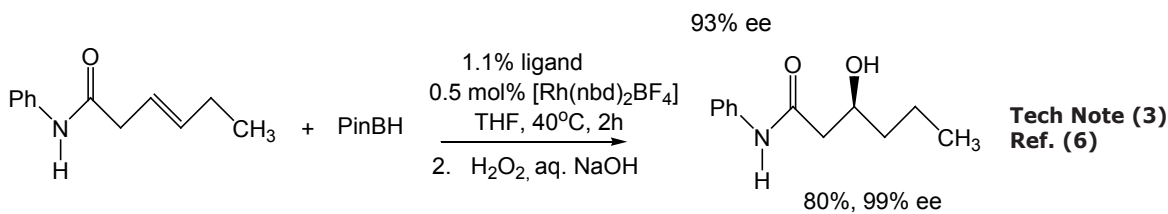
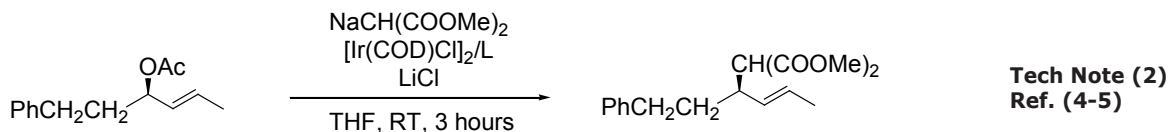
**15-1255 (S)-(+)-(2,6-Dimethyl-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 98%** 100mg  
 500mg  
 CAS# 185449-86-9  
 $C_{24}H_{22}NO_2P$ ; FW: 387.41; off-white pwdr.

Technical Notes:

1. Ligand used in the enantioselective, rhodium-catalyzed hydrogenation of substituted olefins, such as N-acetyldihydroamino acids, enamides, and unsaturated acids.
2. Ligand used in the enantioselective, iridium-catalyzed allylic substitution of allyl acetates containing only a single substituent in the 1 or 3 position.
3. Ligand used in the rhodium-catalyzed, amide directed, asymmetric hydroboration reaction.



R = H, Ph R' = H, CH<sub>3</sub> Z = NHCOCH<sub>3</sub>, CH<sub>2</sub>COOH >97% ee



References:

1. *J. Am. Chem. Soc.*, **2000**, 122, 11539.
2. *Adv. Synth. Catal.*, **2003**, 345, 308.
3. *Adv. Synth. Catal.*, **2002**, 344, 1003.
4. *Chem. Comm*, **1999**, 741.
5. *Eur. J. Inorg. Chem.*, **2002**, 2569.
6. *J. Am. Chem. Soc.*, **2008**, 130, 3734.
7. *Ad. Synth. Catal*, **2012**, 354, 2433.
8. *J. Org. Chem.*, **2013**, 78, 2736.

**15-1505 (3aR,8aR)-(-)-(2,2-Dimethyl-4,4,8,8-tetraphenyl-tetrahydro[1,3]dioxolo[4,5-e][1,3,2]dioxaphosphin-6-yl)dimethylamine, min. 98%** 100mg  
 500mg  
 CAS# 213843-90-4  
 $C_{33}H_{34}NO_4P$ ; FW: 539.60; white pwdr.

Technical Notes:

1. Monodendate ligand for the enantioselective intramolecular reaction of prochiral cyclohexadienones.
2. Ligand use in the palladium-catalyzed, enantioselective diboration of allenes.
3. Enantioselective Rh-catalyzed [2+2+2] cycloaddition of alkynes and isocyanates.
4. Palladium-catalyzed enantioselective C-H arylation.
5. Palladium-catalyzed dynamic kinetic cross-coupling.
6. Palladium-catalyzed enantioselective C-H arylation.

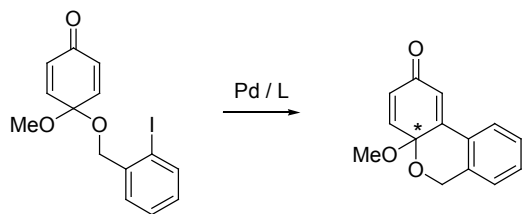
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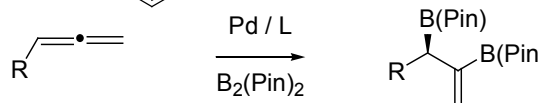
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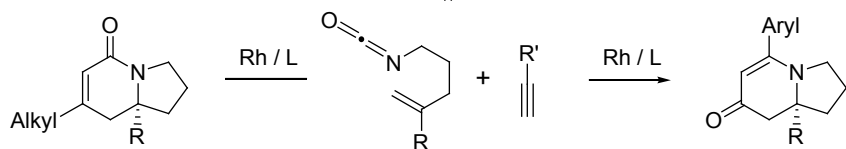
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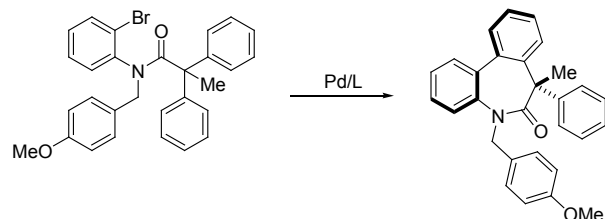
Tech Note (1)  
Ref. (1)



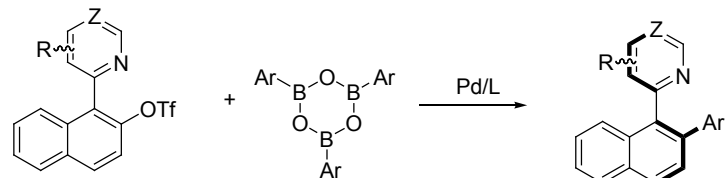
Tech Note (2)  
Ref. (2)



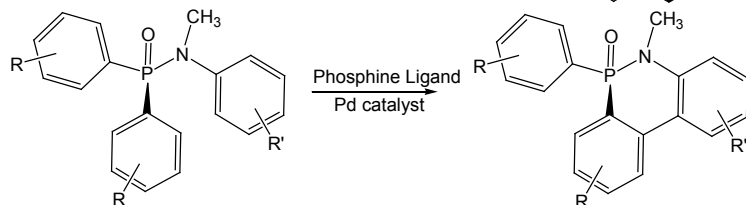
Tech Note (3)  
Ref. (3)



Tech Note (4)  
Ref. (4)



Tech Note (5)  
Ref. (5)



Tech Note (6)  
Ref. (6)

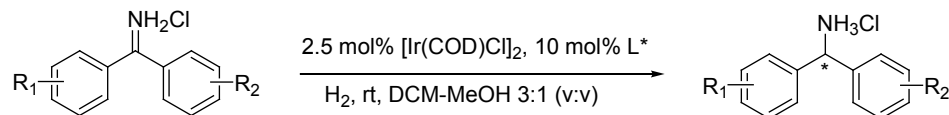
References:

1. *J. Am. Chem. Soc.*, **2002**, 124, 184.
2. *J. Am. Chem. Soc.*, **2004**, 126, 16328.
3. *Org. Lett.*, **2008**, 10, 1231.
4. *Angew. Chem. Int. Ed.*, **2013**, 52, 7865.
5. *J. Am. Chem. Soc.*, **2013**, 135, 15730.
6. *Angew. Chem. Int. Ed.*, **2015**, 54, 6265.

**15-1510 (S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)benzyl(methyl)amine, 99%** 100mg  
 CAS# 490023-37-5 500mg  
 C<sub>28</sub>H<sub>22</sub>NO<sub>2</sub>P; FW: 435.45; white pwdr.

Technical Notes:

1. The ligand has been used in Ir-catalyzed asymmetric hydrogenation of substituted benzophenone N-H imines
2. The ligand has been used in the rhodium-catalyzed enantioselective hydrogenation of (E)-N-acylated dehydro-β-aminoacid esters (For (Z) isomer, use 15-1525).



Tech Note (1)  
Ref. (1)

R<sup>1</sup>, R<sup>2</sup> = Me, OMe, CF<sub>3</sub>, F, Cl, Br

80 - 96 % yield  
76 - 98 % ee

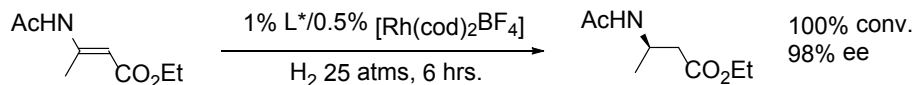
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Tech Note (2)  
Ref. (2)

References:

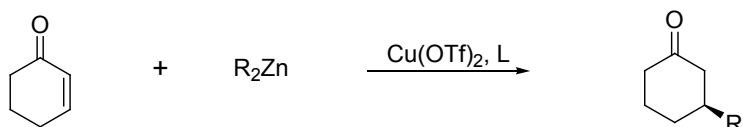
1. *J. Am. Chem. Soc.*, **2010**, *132*, 2124.
2. *J. Am. Chem. Soc.*, **2002**, *124*, 14552.

**15-1520** (S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1R)-1-phenylethyl] amine, dichloromethane adduct, min. 95%  
CAS# 415918-91-1  
C<sub>36</sub>H<sub>30</sub>NO<sub>2</sub>P; FW: 539.60; white pwr.

100mg  
500mg

Technical Notes:

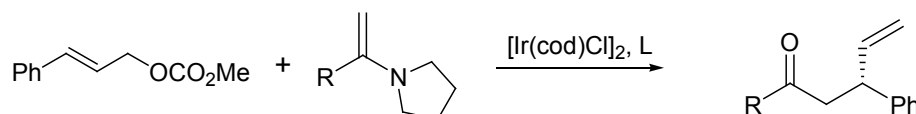
1. A ligand for asymmetric conjugate addition of dialkyl zinc reagents to activated olefins.
2. Ligand used in the iridium-catalyzed, enantioselective addition of nucleophiles to achiral allylic esters.
3. Asymmetric hydrogenation.
4. Ir-catalyzed regio- and enantioselective Friedel-Crafts allylic alkylation of indoles.
5. Asymmetric hydrovinylation.
6. Used in 1,3-dipolar cycloaddition reactions of azomethine ylides and alkenes<sup>9a</sup>, and Rh-catalyzed [5+2] cycloaddition of alkyne-vinyl-cyclopropanes.<sup>9b</sup>
7. Palladium-catalyzed enantioselective de-epimerization in catalytic asymmetric allylic alkylation.
8. Palladium-catalyzed enantioselective diamination of alkyl dienes.



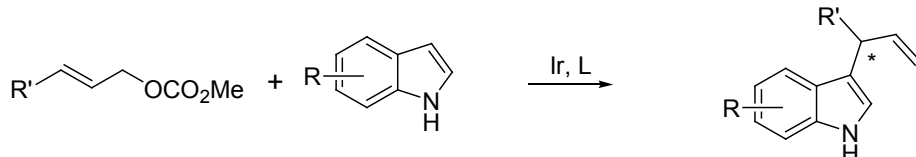
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Ref. (1)



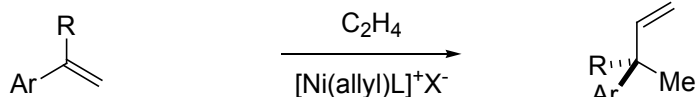
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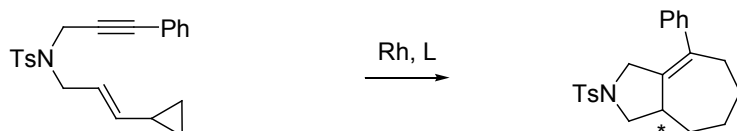
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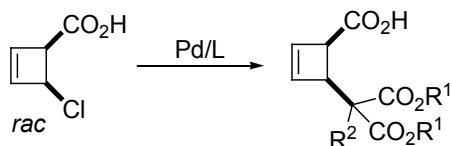
Tech Note (4)  
Ref. (7)



Tech Note (5)  
Ref. (8)



Tech Note (6)  
Ref. (9b)



Tech Note (7)  
Ref. (10)

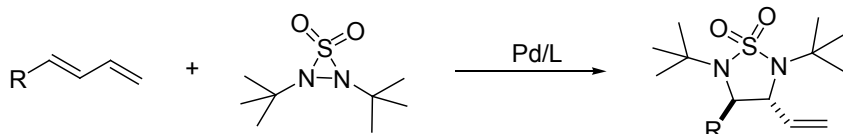
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**Tech Note (8)**  
**Ref. (11)**

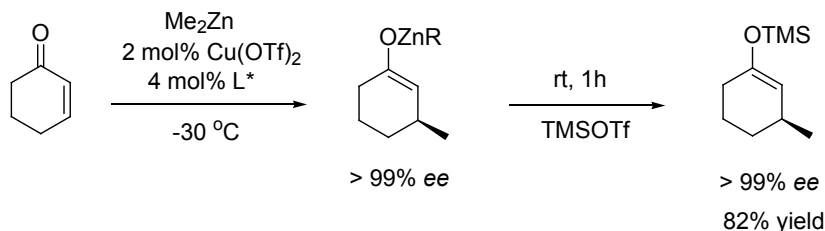
References:

1. *Angew. Chem. Int. Ed.*, **1997**, 36, 2620.
2. *J. Am. Chem. Soc.*, **2002**, 124, 15164.
3. *J. Am. Chem. Soc.*, **2003**, 125, 3426.
4. *Org. Lett.*, **2005**, 7, 1093.
5. *J. Am. Chem. Soc.*, **2007**, 129, 7720.
6. *Acc. Chem. Res.*, **2007**, 40, 1267.
7. *Org. Lett.*, **2008**, 10, 1815.
8. *Synthesis*, **2009**, 2089.
9. (a) *Angew. Chem. Int. Ed.*, **2008**, 47, 6055.  
(b) *Chem. Eur. J.*, **2009**, 15, 8692.
10. *Angew. Chem. Int. Ed.*, **2012**, 51, 7314.
11. *Org. Lett.*, **2013**, 15, 796.

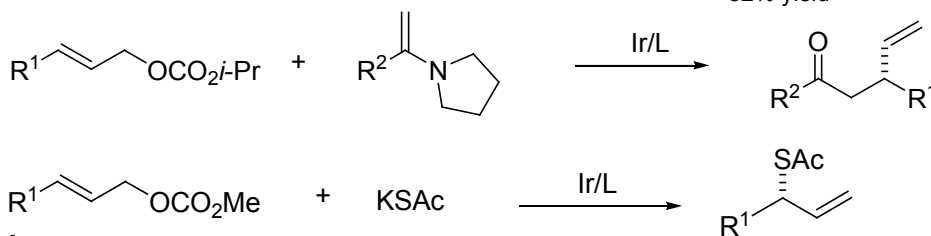
**15-1521 (S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)bis[(1S)-1-phenylethyl] amine, min. 95%** 100mg  
 500mg  
 CAS# 380230-02-4  
 C<sub>36</sub>H<sub>30</sub>NO<sub>2</sub>P; FW: 539.60; off-white powder.

Technical Notes:

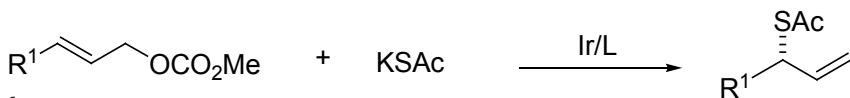
1. A ligand for asymmetric conjugate addition of dialkyl zinc reagents to activated olefins.
2. Iridium-catalyzed regioselective and enantioselective allylation of enamines.
3. Iridium-catalyzed asymmetric allylation of KSAC.



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



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



**Tech Note (3)**  
**Ref. (3)**

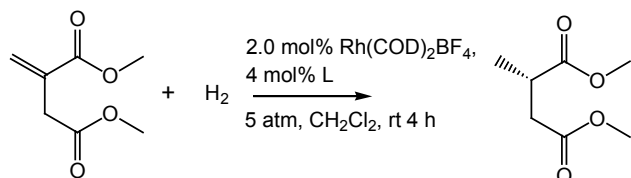
References:

1. *Org. Lett.*, **2002**, 4, 3835.
2. *J. Am. Chem. Soc.*, **2007**, 129, 7720.
3. *Eur. J. Org. Chem.*, **2013**, 2708.

**15-1231 (S)-(+)-(3,5-Dioxa-4-phosphacyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)diethylamine, min. 97%** 250mg  
 1g  
 CAS# 252288-04-3  
 C<sub>24</sub>H<sub>22</sub>NO<sub>2</sub>P; FW: 387.41; white powder.

Technical Notes:

1. See 15-1232.
2. Ligand used in the enantioselective rhodium catalyzed low pressure high activity hydrogenation of α-dehydroaminoesters, enamides, and dimethylitaconate.
3. Ligand used in enantioselective rhodium-catalyzed allylic C-H activation for addition to conjugated dienes.



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

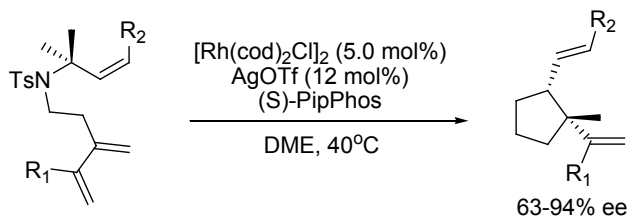
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**Tech Note (3)**  
**Ref. (2)**

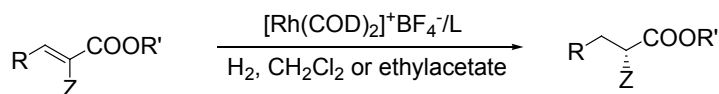
References:

1. *J. Org. Chem.*, **2005**, 70, 943.
2. *Angew. Chem. Int. Ed.*, **2011**, 50, 2144.

**15-1232 (R)-(-)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97%** 250mg  
**(R)-MONOPHOS** 1g  
 CAS# 157488-65-8  
 $\text{C}_{22}\text{H}_{18}\text{NO}_2\text{P}$ ; FW: 359.36; white xtl.

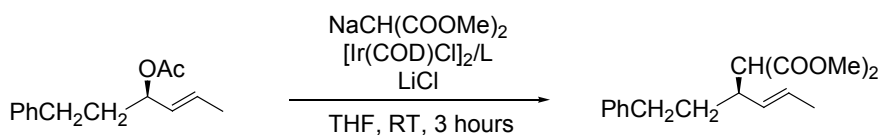
Technical Notes:

1. Ligand used in the enantioselective, rhodium-catalyzed hydrogenation of substituted olefins, such as N-acetyldihydroamino acids, enamides, and unsaturated acids.
2. Ligand used in the enantioselective, iridium-catalyzed allylic substitution of allyl acetates containing only a single substituent in the 1 or 3 position.
3. Ligand use in the rhodium-catalyzed, amide directed, asymmetric hydroboration reaction.
4. Ligand used in asymmetric conjugate addition of aryl boronic acids to dihydronaphthalenes.
5. Ligand used in the rhodium-catalyzed asymmetric intramolecular 1,4 addition.

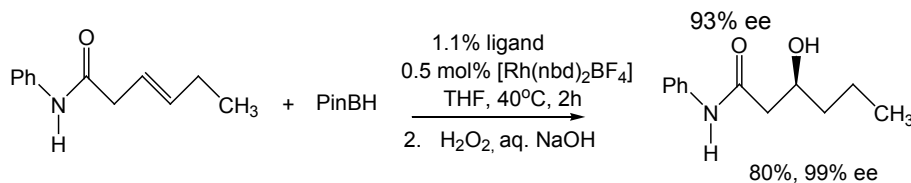


**Tech Note (1)**  
**Ref. (1-3)**

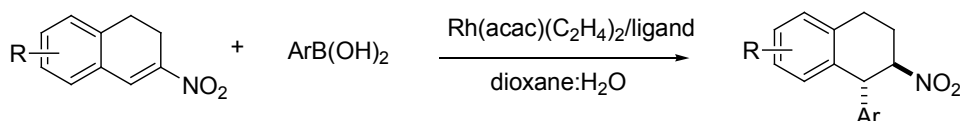
R = H, Ph R' = H, CH<sub>3</sub> Z = NHCOCH<sub>3</sub>, CH<sub>2</sub>COOH >97% ee



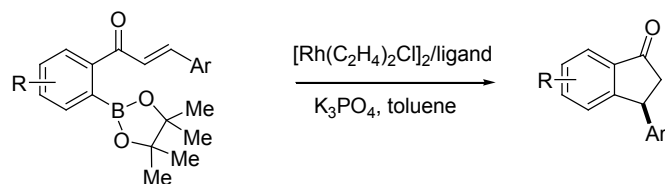
**Tech Note (2)**  
**Ref. (4,5)**



**Tech Note (3)**  
**Ref. (6)**



**Tech Note (4)**  
**Ref. (7)**



**Tech Note (4)**  
**Ref. (8)**

References:

1. *J. Am. Chem. Soc.*, **2000**, 122, 11539.
2. *Adv. Synth. Catal.*, **2003**, 345, 308.
3. *Adv. Synth. Catal.*, **2002**, 344, 1003.
4. *Chem. Comm*, **1999**, 741.
5. *Eur. J. Inorg. Chem.*, **2002**, 2569.
6. *J. Am. Chem. Soc.*, **2008**, 130, 3734.
7. *Ad. Synth. Catal.*, **2012**, 354, 2433.
8. *J. Org. Chem.*, **2013**, 78, 2736.

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**15-1233 (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, min. 97% (S)-MONOPHOS** 250mg  
 1g  
 CAS# 185449-80-3  
 $C_{22}H_{18}NO_2P$ ; FW: 359.36; white xtl.

Technical Notes:

1. See 15-1232.
2. Asymmetric hydrogenation of ketones and  $\beta$ -keto esters.
3. Light-induced, enantioselective hydrogenation.

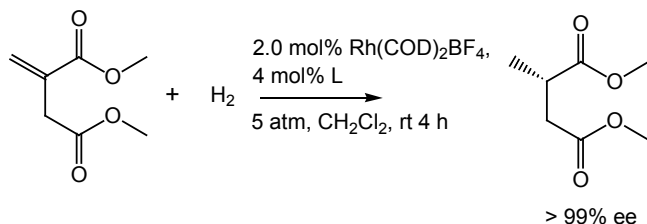
References:

1. *Org. Lett.*, **2004**, 6, 4105.
2. *Agnew. Chem. Int. Ed.*, **2004**, 43, 5066.
3. *J. Org. Chem.*, **2005**, 70, 943.
4. *Organometallics*, **2011**, 30, 3880.

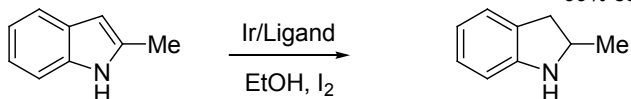
**15-1235 (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)morpholine, min. 97% (S)-MorPhos** 100mg  
 500mg  
 CAS# 185449-81-4  
 $C_{24}H_{20}NO_3P$ ; FW: 401.39; white pwdr.

Technical Notes:

1. See 15-1232.
2. Ligand used in the enantioselective rhodium catalyzed low pressure high activity hydrogenation of  $\alpha$ -dehydroaminoesters, enamides, and dimethylitaconate. See 15-1234.
3. Ligand used in iridium-catalyzed asymmetric hydrogenation of 2-methylindole



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



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

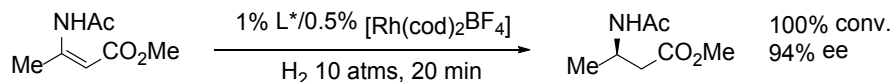
References:

1. *J. Org. Chem.*, **2005**, 70, 943.
2. *Tetrahedron*, **2014**, 55, 3613.

**15-1525 (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)[(1R)-1-phenylethyl] amine, min. 95%** 100mg  
 500mg  
 CAS# 422509-53-3  
 $C_{28}H_{22}NO_2P$ ; FW: 435.45; white pwdr.

Technical Notes:

1. The ligand for the rhodium-catalyzed enantioselective hydrogenation of (E)-N-acylated dehydro- $\beta$ -aminoacid esters.



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

References:

1. *J. Am. Chem. Soc.*, **2002**, 124, 14552.

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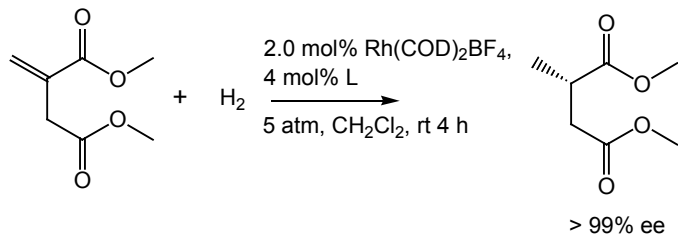
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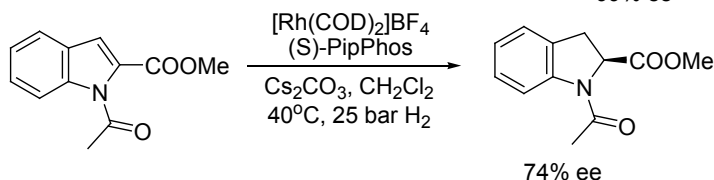
**15-1234 (S)-(+)-(3,5-Dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)piperidine, min. 97%** 100mg  
**(S)-PipPhos** 500mg  
 CAS# 284472-79-3 2g  
 C<sub>25</sub>H<sub>22</sub>NO<sub>2</sub>P; FW: 399.42; white pwdr.

Technical Notes:

1. See 15-1232.
2. Ligand used in the enantioselective rhodium catalyzed low pressure high activity hydrogenation of α-dehydroaminoesters, enamides, and dimethylitaconate.
3. Ligand used in asymmetric hydrogenation of 2-substituted N-protected indoles using Rhodium-based catalysts.



Tech Note (2)  
 Ref. (1)



Tech Note (3)  
 Ref. (2)

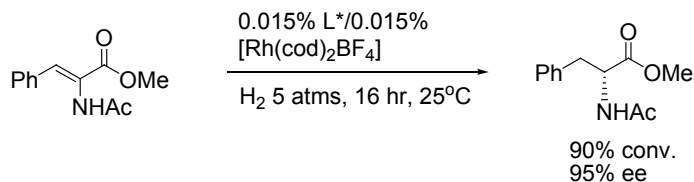
References:

1. *J. Org. Chem.*, **2005**, *70*, 943.
2. *Tetrahedron*, **2010**, *21*, 7.
3. *Organometallics.*, **2011**, *30*, 1942.
4. *Adv. Synth. Catal.*, **2011**, 353.

**15-3495 (S)-(+)-(8,9,10,11,12,13,14,15-Octahydro-3,5-dioxa-4-phospha-cyclohepta[2,1-a;3,4-a']dinaphthalen-4-yl)dimethylamine, 99%** 100mg  
 CAS# 389130-06-7 500mg  
 C<sub>22</sub>H<sub>26</sub>NO<sub>2</sub>P; FW: 367.42; white pwdr.

Technical Notes:

1. A ligand for enantioselective hydrogenation of prochiral functional olefins.



Tech Note (1)  
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References:

1. *Adv. Synth. Catal.*, **2003**, *345*, 308.

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