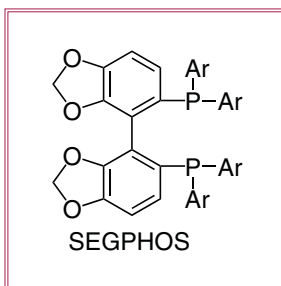


## SEGPHOS® Catalyst & Ligand Kits for asymmetric hydrogenation & other catalytic applications

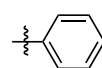
**SEGPHOS®** works particularly well in asymmetric hydrogenation of  $\alpha$ -,  $\beta$ -, and  $\gamma$ -functionalized ketones. In most cases, catalytic activities and enantioselectivities achieved by SEGPHOS®-ruthenium complexes are higher than those by BINAP counterparts. Other SEGPHOS®-metal complexes also afford excellent results in a wide variety of asymmetric reactions.

**DM-SEGPHOS®** has slightly bulkier pendant groups than SEGPHOS®, and DM-SEGPHOS® is great at producing high enantioselectivity in reductive amination of  $\beta$ -keto esters to  $\beta$ -amino acids.

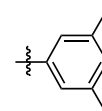
Replacing XylBINAP with DM-SEGPHOS® as a ligand in Noyori's  $[RuX_2(P^*P(N^*N))]$  complex has been known to improve enantioselectivity in difficult reduction reactions. **DTBM-SEGPHOS®** provides an extremely sterically demanding environment around the metal center. One of the most remarkable results is asymmetric hydrogenation of 2-substituted 3-oxocarboxylates, accompanied by dynamic kinetic resolution. Due to its unique structural and electronic features, many complexes of DTBM-SEGPHOS® such as gold, palladium and especially copper complexes show excellent activities and enantioselectivities in a variety of asymmetric reactions



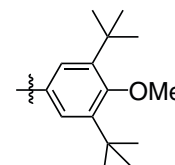
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SEGPHOS



DM-SEGPHOS



DTBM-SEGPHOS

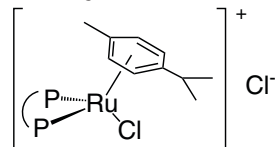
These kits contain 250mg of each of the items listed below it. All items are available for individual sale in 250mg, 1g & 5g unit sizes.

### 96-6900 Takasago SEGPHOS® Ligand Kit

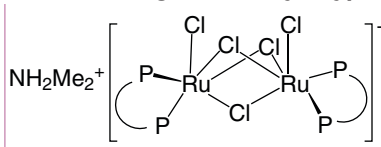
Item#	Acronym	CAS#	Item#	Acronym	CAS#
15-0066	(R)-(-)-DTBM-SEGPHOS®	566940-03-2	15-0067	(S)-(+)-DTBM-SEGPHOS®	210169-40-7
15-0136	(R)-(+)-SEGPHOS®	244261-66-3	15-0137	(S)-(-)-SEGPHOS®	210169-54-3
15-0478	(R)-(+)-DM-SEGPHOS®	850253-53-1	15-0479	(S)-(-)-DM-SEGPHOS®	210169-57-6

### 96-6901 Takasago SEGPHOS® Ru Catalyst Kit

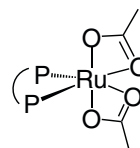
Metal catalysts in this kit are from the following four catalyst types:



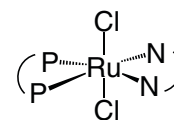
$[RuCl(p\text{-cymene})(P^*P)]Cl$  (I)



$[NH_2Me_2][\{RuCl(P^*P)\}_2(\mu\text{-Cl})_3]$  (II)



$[Ru(OAc)_2(P^*P)]$  (III)



$[RuCl_2(P^*P)(N^*N)]$  (IV)

Item#	Acronym (Ligand P^*P)	CAS#	Item#	Acronym (Ligand P^*P)	CAS#
$[RuCl(p\text{-cymene})(P^*P)]Cl$ (I)					
44-0096	(R)-SEGPHOS®	944451-28-9	44-0097	(S)-SEGPHOS®	944451-29-0
44-0098	(R)-DM-SEGPHOS®	944451-30-3	44-0099	(S)-DM-SEGPHOS®	944451-31-4
44-0102	(R)-DTBM-SEGPHOS®	944451-32-5	44-0103	(S)-DTBM-SEGPHOS®	944451-33-6
$[NH_2Me_2][\{RuCl(P^*P)\}_2(\mu\text{-Cl})_3]Cl$ (II)					
44-0518	(R)-SEGPHOS®	346457-41-8	44-0519	(S)-SEGPHOS®	488809-34-3
44-0520	(R)-DM-SEGPHOS®	935449-46-0	44-0521	(S)-DM-SEGPHOS®	944451-14-3
$[Ru(OAc)_2(P^*P)]$ (III)					
44-0168	(R)-SEGPHOS®	944450-48-0	44-0169	(S)-SEGPHOS®	373650-12-5
44-0174	(R)-DM-SEGPHOS®	944450-50-4	44-0176	(S)-DM-SEGPHOS®	944450-50-4
44-0180	(R)-DTBM-SEGPHOS®	1025477-38-6	44-0181	(S)-DTBM-SEGPHOS®	1025476-84-9
$[RuCl_2(P^*P)(N^*N)]$ (IV)					
44-0214	(R)-DM-SEGPHOS® (daiphen)	944450-43-5	44-0215	(S)-DM-SEGPHOS® (daiphen)	944450-44-6
44-0228	(R)-DM-SEGPHOS® (dpen)	944450-45-7	44-0229	(S)-DM-SEGPHOS® (dpen)	944450-46-8

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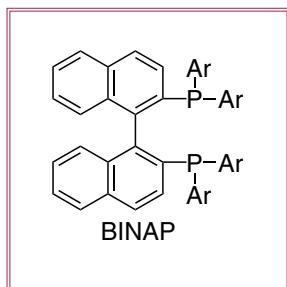
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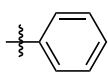
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## BINAP Catalyst & Ligand Kits for asymmetric hydrogenation & other catalytic applications

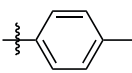
**BINAP** is a chiral ligand that has been used in a variety of asymmetric reactions since 1980. Especially BINAP-Ru complex affords high enantioselectives in asymmetric hydrogenations of a wide range of olefins and functionalized ketones.



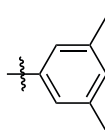
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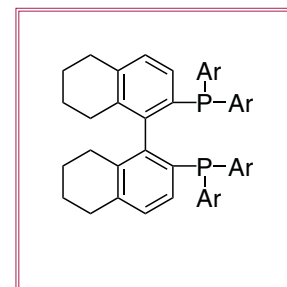
BINAP



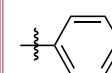
ToIBINAP



XyIBINAP



Ar:



H<sub>8</sub>-BINAP

**ToIBINAP** has high solubility in organic solvents. This

property solves the problems caused by low solubility intrinsic to BINAP and its complexes. **XyIBINAP** is usually used in the Noyori's Ru-Diphosphine-Diamine complexes for hydrogenation of simple ketones. In many cases this ligand gives higher ee values than those with BINAP or ToIBINAP. **H<sub>8</sub>-BINAP**-Ru complexes hydrogenate unsaturated carboxylic acids in higher enantioselectives than BINAP-Ru complexes do.

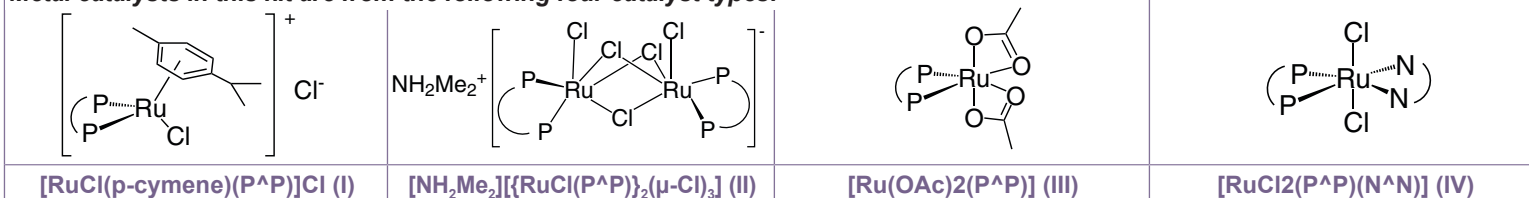
*These kits contain 250mg of each of the items listed below it. All items are available for individual sale in 250mg, 1g & 5g unit sizes*

### 96-6950 Takasago BINAP Ligand Kit

Item#	Acronym	CAS#	Item#	Acronym	CAS#
15-0150	(R)-(+)-BINAP	76189-55-4	15-0151	(S)-(-)-BINAP	76189-56-5
15-0152	(R)-(+)-ToIBINAP	99646-28-3	15-0153	(S)-(-)-ToIBINAP	100165-88-6
15-0476	(R)-(+)-XyIBINAP	137219-86-4	15-0477	(S)-(-)-XyIBINAP	135139-00-3

### 96-6953 Takasago BINAP Ru Acetate Catalyst Kit

Metal catalysts in this kit are from the following four catalyst types:



Item#	Acronym (Ligand P <sup>*</sup> P)	CAS#	Item#	Acronym (Ligand P <sup>*</sup> P)	CAS#
<i>[Ru(OAc)<sub>2</sub>(P<sup>*</sup>P)](III)</i>					
44-0152	(R)-BINAP	325146-81-4	44-0153	(S)-BINAP	261948-85-0
44-0162	(R)-ToIBINAP	116128-29-1	44-0163	(S)-ToIBINAP	106681-15-6
44-0164	(R)-XyIBINAP	374067-50-2	44-0165	(S)-XyIBINAP	374067-49-9

### 96-6951 Takasago BINAP Ru Cymene Catalyst Kit

Item#	Acronym (Ligand P <sup>*</sup> P)	CAS#	Item#	Acronym (Ligand P <sup>*</sup> P)	CAS#
<i>[RuCl[(p-cymene)(P<sup>*</sup>P)]Cl(I)</i>					
44-0084	(R)-BINAP	145926-28-9	44-0086	(S)-BINAP	130004-33-0
44-0088	(R)-ToIBINAP	131614-43-2	44-0089	(S)-ToIBINAP	228120-95-4
44-0092	(R)-XyIBINAP	944451-24-5	44-0093	(S)-XyIBINAP	944451-25-6

### 96-6954 Takasago BINAP Ru Diamine Catalyst Kit

Item#	Acronym (Ligand P <sup>*</sup> P)	CAS#	Item#	Acronym (Ligand P <sup>*</sup> P)	CAS#
<i>[RuCl<sub>2</sub>(P<sup>*</sup>P)(N<sup>*</sup>N)](IV)</i>					
44-0212	RuCl <sub>2</sub> [(R)-XyIBINAP][(R)-daipen]	220114-32-9	44-0213	RuCl <sub>2</sub> [(S)-XyIBINAP][(S)-daipen]	220114-01-2
44-0217	(R)-RUCY®XyIBINAP	1384974-38-2	44-0218	(S)-RUCY®XyIBINAP	1312713-89-5
44-0226	RuCl <sub>2</sub> [(S)-XyIBINAP][(S,S)-dpen]	220114-38-5	44-0224	RuCl <sub>2</sub> [(S)-XyIBINAP][(S,S)-dpen]	220114-03-4

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## 96-6952 Takasago BINAP Ru Dimer Catalyst Kit

Item#	Acronym (Ligand P*P)	CAS#	Item#	Acronym (Ligand P*P)	CAS#
[NH <sub>2</sub> Me <sub>2</sub> ][{RuCl(P*P)} <sub>2</sub> (μ-Cl) <sub>3</sub> ]Cl (II)					
44-0510	(R)-BINAP	199684-47-4	44-0511	(S)-BINAP	199541-17-8
44-0512	(R)-ToIBINAP	749935-02-2	44-0513	(S)-ToIBINAP	309735-86-2
44-0514	(R)-XylBINAP	944451-08-5	44-0515	(S)-XylBINAP	944451-10-9

## H<sub>8</sub>-BINAP - Also Available (not included in the above kits) - Unit Sizes: 50mg, 250mg

15-2972	(R)-(+)-H <sub>8</sub> -BINAP	139139-86-9	15-2973	(S)-(-)-H <sub>8</sub> -BINAP	139139-93-8
44-0094	[RuCl(p-cymene)((R)-H <sub>8</sub> -BINAP)]Cl	944451-26-7	44-0095	[RuCl(p-cymene)((S)-H <sub>8</sub> -BINAP)]Cl	944451-27-8
44-0516	[NH <sub>2</sub> Me <sub>2</sub> ][{RuCl((R)-H <sub>8</sub> -BINAP)} <sub>2</sub> (μ-Cl) <sub>3</sub> ]	204933-84-6	44-0517	[NH <sub>2</sub> Me <sub>2</sub> ][{RuCl((S)-H <sub>8</sub> -BINAP)} <sub>2</sub> (μ-Cl) <sub>3</sub> ]	944451-12-1
44-0166	Ru(OAc) <sub>2</sub> [(R)-H <sub>8</sub> -BINAP]	374067-51-3	44-0167	Ru(OAc) <sub>2</sub> [(S)-H <sub>8</sub> -BINAP]	142962-95-6

## ATH (Asymmetric Transfer Hydrogenation) Catalyst Kit

By using 2-propanol or formic acid as the hydrogen source, asymmetric transfer hydrogenation can avoid the use of high pressure hydrogen gas. In addition, experimental procedures are simple. Ruthenium complexes bearing chiral bidentate nitrogen ligand and arene are highly efficient for reduction of a broad range of ketones and imines to chiral alcohols and amines.

*This kit contains 250mg of each of the items listed below it. All items are available for individual sale in 250mg, 1g & 5g unit sizes*

44-0148 RuCl[(R,R)-Tsdpen](p-cymene)	44-0154 RuCl[(R,R)-Tsdpen(mesitylene)]	44-0156 RuCl[(R,R)-Fsdpen](p-cymene)	44-0185 (R,R)-Ts-DENEB®
44-0149 RuCl[(S,S)-Tsdpen](p-cymene)	44-0155 RuCl[(S,S)-Tsdpen(mesitylene)]	44-0157 RuCl[(S,S)-Fsdpen](p-cymene)	44-0186 (S,S)-Ts-DENEB®
44-0217 (R)-RUCY®-XylBINAP		44-0255 Ru-(R,R)-Ms-DENEB®	
44-0218 (S)-RUCY®-XylBINAP		44-0256 Ru-(S,S)-Ms-DENEB®	

## 96-6955 Takasago ATH (Asymmetric Transfer Hydrogenation) Catalyst

Item#	Acronym	CAS#	Item#	Acronym	CAS#
44-0148	RuCl[(R,R)-Tsdpen](p-cymene)	192139-92-7	44-0149	RuCl[(S,S)-Tsdpen](p-cymene)	192139-90-5
44-0154	RuCl[(R,R)-Tsdpen(mesitylene)]	174813-82-2	44-0155	RuCl[(S,S)-Tsdpen(mesitylene)]	174813-81-1
44-0156	RuCl[(R,R)-Fsdpen](p-cymene)	1026995-71-0	44-0157	RuCl[(S,S)-Fsdpen](p-cymene)	1026995-72-1
44-0185	(R,R)-Ts-DENEB®	1333981-84-2	44-0186	(S,S)-Ts-DENEB®	1384974-37-1
44-0217	(R)-RUCY XylBINAP	1384974-38-2	44-0218	(S)-RUCY XylBINAP	1312713-89-5
44-0255	(R,R)-Ms-DENEB®	1333981-86-4	44-0256	(S,S)-Ms-DENEB®	1361318-83-3

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## BRIDP Ligands for C-C and C-X coupling

**Monophosphine Ligands for Pd-catalyzed Coupling Reaction** - The common characteristics of efficient ligands for cross-coupling reactions are the unique levels of electron-richness and steric hindrance. In order to achieve more efficiency and versatility in cross-coupling reactions, TAKASAGO has designed and developed a new family of phosphine ligands, BRIDPs.

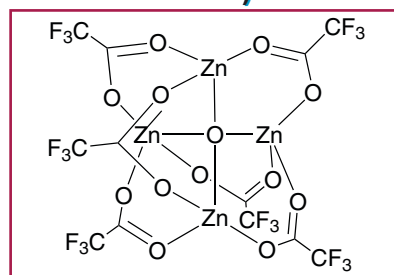
15-1005	15-1007	15-1062	15-1065
cBRIDP	Cy-cBRIDP	Cy-vBRIDP	vBRIDP

Item#	Description	CAS#	Unit Sizes
15-1005	Dicyclohexyl(2,2-diphenyl-1-methylvinyl)phosphine Cy-vBRIDP	742103-27-1	250mg, 1g, 5g
15-1007	Dicyclohexyl(2,2-diphenyl-1-methylcyclopropyl)phosphine Cy-cBRIDP	1023330-38-2	250mg, 1g, 5g
15-1062	Dicyclohexyl(2,2-diphenyl-1-methylvinyl)phosphine Cy-vBRIDP	384842-24-4	250mg, 1g, 5g
15-1065	Di-t-butyl(2,2-diphenyl-1-methylvinyl)phosphine, min. 98% vBRIDP	384842-25-5	250mg, 1g, 5g

## ZnTAC24™ Zinc catalyst for a variety of transformations (e.g. Catalytic Acylation of Alcohols)

**ZnTAC24™**, a mixture of Zn-Cluster  $[Zn_4(OCOCF_3)_6O]$  developed by Mashima group at Osaka university and its trifluoroacetic acid adduct, catalyzes a wide variety of condensation reactions such as oxazoline syntheses and transesterifications.

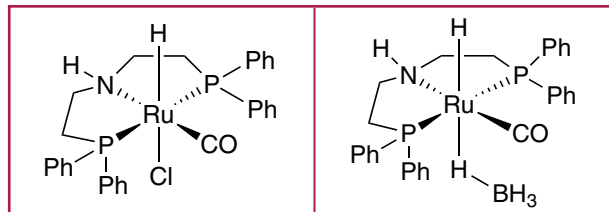
- (1) Oxazoline synthesis; Easily available carboxylic acids and esters can be utilized instead of nitrile compounds. In the case that chiral amino alcohols are used, loss of optical purity does not occur.
- (2) Transesterification; Less expensive carboxylic acid esters can be used as an acylating reagents. In reactions between amino alcohols and esters, O-acylated compounds are obtained with high chemoselectivity.
- (3) ZnTAC24™ is also employed for protection/deprotection of hydroxyl groups coexisting with acid-sensitive functional groups.



Item#	Description	CAS#	Unit Sizes
30-4050	Oxo[hexa(trifluoroacetato)]tetrazinc trifluoroacetic acid adduct ZnTAC24™	1299489-47-6	5g, 25g

## Ru-MACHO® Ester Reduction Catalyst

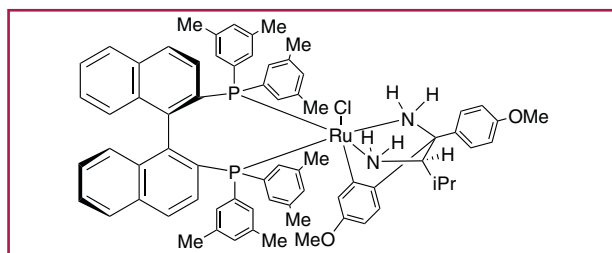
**Ru-MACHO®** is a novel ruthenium catalyst for homogeneous hydrogenations of esters. This catalyst is applicable for a wide variety of ester substrates under mild reaction condition. In particular, **Ru-MACHO®-BH** is applicable for a wide variety of ester substrates under base free condition



Item#	Description	CAS#	Unit Sizes
44-0071	Carbonylchlorohydrido[bis(2-(diphenylphosphinoethyl)amino)ruthenium(II), min.98% Ru-MACHO®	1295649-40-9	250mg, 1g, 5g
44-0074	Carbonylhydrido(tetrahydroborato)[bis(2-(diphenylphosphinoethyl)amino)ruthenium(II), min.98% Ru-MACHO®-BH	1295649-41-0	250mg, 1g, 5g

## RUCY® Highly Efficient Asymmetric Hydrogenation Catalyst

**RUCY®** is a novel ruthenabicyclic complex. This complex with base shows excellent catalytic activity in the asymmetric hydrogenation of ketones. In the case of hydrogenation of acetophenone, the turnover frequency reaches about 35000min<sup>-1</sup>, affording 1-phenylethanol in >99% ee. Several base-labile and bicyclic ketones, which are difficult substrates to hydrogenate with reported catalyst system (RuCl<sub>2</sub>(diphosphine)(diamine)/t-BuOK), are smoothly converted to the corresponding alcohols in high enantioselectivity.



Item#	Acronym	CAS#	Item#	Acronym	CAS#
44-0217	(R)-RUCY® XylBINAP	1384974-38-2	44-0218	(S)-RUCY® XylBINAP	1312713-89-5

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