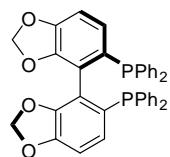


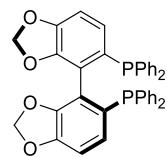
SEGPHOS[®]

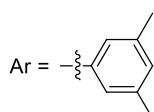
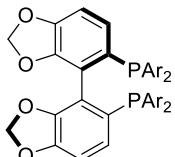
SEGPHOS[®] works particularly well in asymmetric hydrogenation of α -, β -, and γ -functionalized ketones. In most cases, catalytic activities and enantioselectivities achieved by **SEGPHOS[®]**-ruthenium complexes are higher than those by BINAP counterparts.

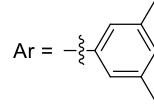
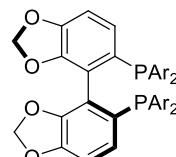
DM-SEGPHOS[®] is great at producing high enantioselectivity in reductive amination of β -keto esters to β -amino acids. Replacing XyIBINAP with **DM-SEGPHOS[®]** as a ligand in Noyori's $[\text{RuX}_2(\text{P}^{\wedge}\text{P})(\text{N}^{\wedge}\text{N})]$ complex has been known to improve enantioselectivity in difficult reduction reactions.

"SEGPHOS" is a registered trademark of Takasago International Corporation in Japan and other countries.

(R)-(+)-SEGPHOS[®]**CAS No.** 244261-66-3**Formula** C₃₈H₂₈O₄P₂**M.W.** 610.59

(S)-(-)-SEGPHOS[®]**CAS No.** 210169-54-3**Formula** C₃₈H₂₈O₄P₂**M.W.** 610.59

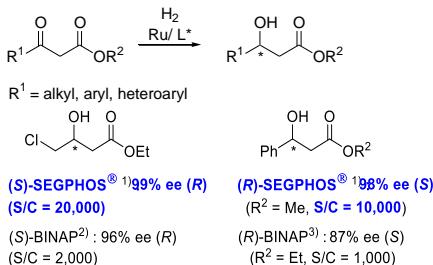
(R)-(+)-DM-SEGPHOS[®]**CAS No.** 850253-53-1**Formula** C₄₆H₄₄O₄P₂**M.W.** 722.81

(S)-(-)-DM-SEGPHOS[®]**CAS No.** 210169-57-6**Formula** C₄₆H₄₄O₄P₂**M.W.** 722.81

Tech Note

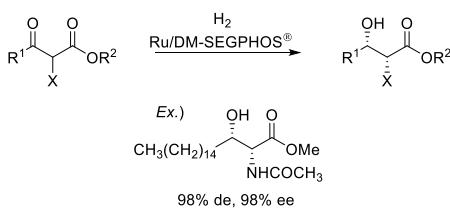
1 Ru Catalyzed Asymmetric Hydrogenation

1.1 β -Ketoesters



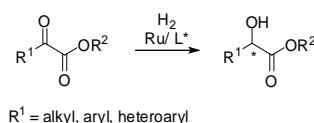
Saito, T.; Yokozawa, T.; Ishizaki, T.; Moroi, T.; Sayo, N.; Miura, T.; Kumobayashi, H. *Adv. Synth. Catal.* **2001**, 343, 264.
doi:[10.1002/1615-4169\(20010330\)343:3<264::AID-ADSC264>3.0.CO;2-T](https://doi.org/10.1002/1615-4169(20010330)343:3<264::AID-ADSC264>3.0.CO;2-T)

1.2 Dynamic Kinetic Resolution



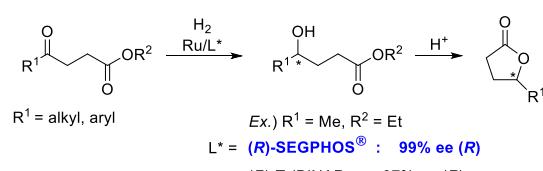
Sumi, K. *Topics Organomet. Chem.* **2004**, 6, 63.
doi: [10.1007/b11768](https://doi.org/10.1007/b11768)

1.3 α -Ketoesters



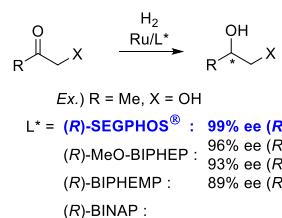
Saito, T.; Yokozawa, T.; Ishizaki, T.; Moroi, T.; Sayo, N.; Miura, T.; Kumobayashi, H. *Adv. Synth. Catal.* **2001**, 343, 264.
doi:[10.1002/1615-4169\(20010330\)343:3<264::AID-ADSC264>3.0.CO;2-T](https://doi.org/10.1002/1615-4169(20010330)343:3<264::AID-ADSC264>3.0.CO;2-T)

1.4 γ -Ketoesters



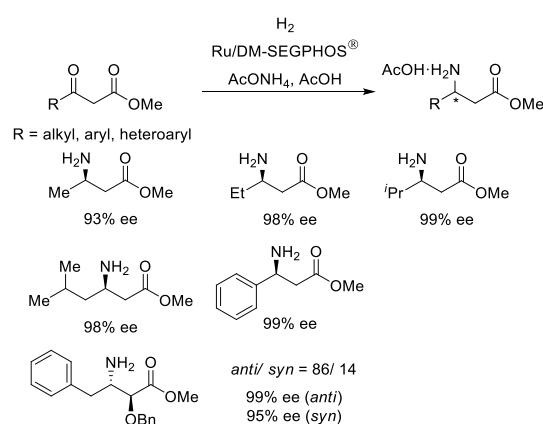
Saito, T.; Yokozawa, T.; Ishizaki, T.; Moroi, T.; Sayo, N.; Miura, T.; Kumobayashi, H. *Adv. Synth. Catal.* **2001**, 343, 264.
doi:[10.1002/1615-4169\(20010330\)343:3<264::AID-ADSC264>3.0.CO;2-T](https://doi.org/10.1002/1615-4169(20010330)343:3<264::AID-ADSC264>3.0.CO;2-T)

1.5 Hydroxyacetones

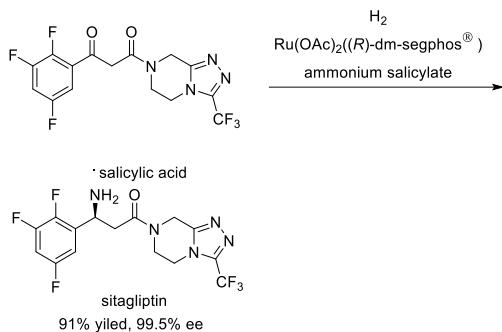


Saito, T.; Yokozawa, T.; Ishizaki, T.; Moroi, T.; Sayo, N.; Miura, T.; Kumobayashi, H. *Adv. Synth. Catal.* **2001**, 343, 264.
doi:[10.1002/1615-4169\(20010330\)343:3<264::AID-ADSC264>3.0.CO;2-T](https://doi.org/10.1002/1615-4169(20010330)343:3<264::AID-ADSC264>3.0.CO;2-T)

1.6 Direct Reductive Amination of β -Keto Esters

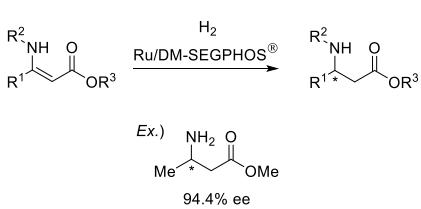


JP4705031B, EP1685092B, EP2100875B, US7626034B, WO2005028419A (Takasago)



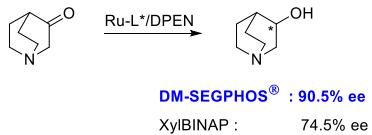
Matsumura, K. *J. Am. Chem. Soc.* **2009**, *131*, 11316.
doi: [10.1021/ja905143m](https://doi.org/10.1021/ja905143m)

1.7 Hydrogenation of Enamino Esters



US7015348B, EP1386901B (Takasago)

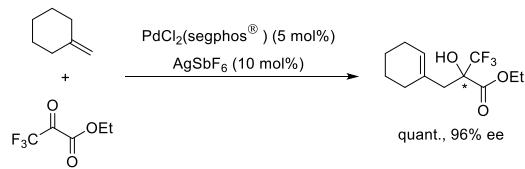
1.8 Hydrogenation of Cycloalkanones



JP4490211B, US7462722B, EP1650207B (Takasago)

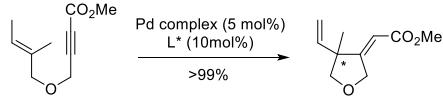
2 Pd Catalyzed Asymmetric Reaction

2.1 Ene-Reaction



Mikami, K.; Aikawa, K.; Kainuma, S.; Kawakami, Y.; Saito, T.; Sayo, N.; Kumobayashi H. *Tetrahedron: Asymm.* **2004**, *15*, 3885.
doi: [10.1016/j.tetasy.2004.10.022](https://doi.org/10.1016/j.tetasy.2004.10.022)

2.2 Ene-Type Cyclization

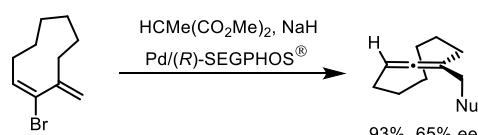


Pd complex	L*	% ee
Pd(OOCF ₃) ₂	(R)-SEGPHOS®	>99% (S)
[Pd(MeCN) ₄] (BF ₄) ₂	(S)-DM-SEGPHOS®	96% (R)
Pd(OCOCF ₃) ₂	(S)-H ₈ -BINAP	95% (R)

Hatano, M.; Terada, M.; Mikami, K. *Angew. Chem. Int. Ed.* **2001**, *40*, 249.

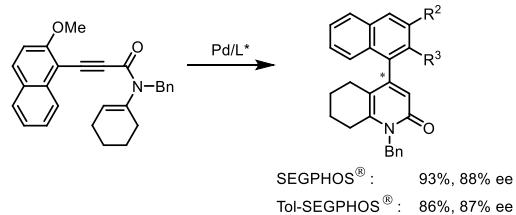
doi: [10.1002/1521-3773\(20010105\)40:1<249::AID-ANIE249>3.0.CO;2-0X](https://doi.org/10.1002/1521-3773(20010105)40:1<249::AID-ANIE249>3.0.CO;2-0X)

2.3 Stereoselective [2 + 2]Cycloaddition with Ketenes



Ogasawara, M.; Okada, A.; Nakajima, K.; Takahashi, T. *Org. Lett.* **2009**, *11*, 177
doi: [10.1021/o10802280c](https://doi.org/10.1021/o10802280c)

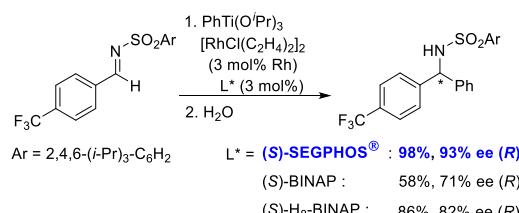
2.4 Cycloisomerization of N-Alkenyl Arylethylnylamides



Imase, H.; Suda, T.; Shibata, Y.; Noguchi, K.; Hirano, M., Tanaka, K. *Org. Lett.* **2009**, *11*, 1805.
doi: [10.1021/o1900373z](https://doi.org/10.1021/o1900373z)

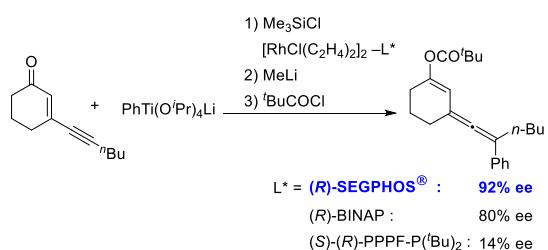
3 Rh Catalyzed Asymmetric Reaction

3.1 1,2-Addition



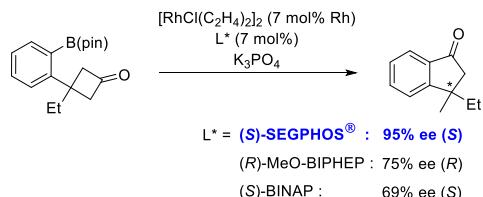
Hayashi, T.; Kawai, M.; Tokunaga, N. *Angew. Chem. Int. Ed.* **2004**, *43*, 6125.
doi: [10.1002/anie.200461338](https://doi.org/10.1002/anie.200461338)

3.2 1,6-Addition



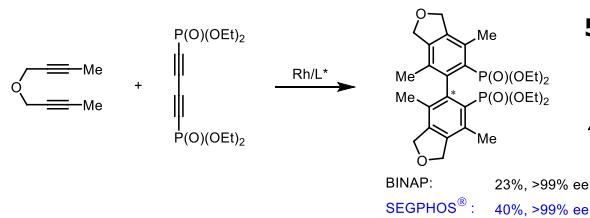
Hayashi, T.; Tokunaga, N.; Inoue, K. *Org. Lett.* **2004**, *6*, 305.
doi: [10.1021/o1036309f](https://doi.org/10.1021/o1036309f)

3.3 C-C Bond Cleavage



Matsuda, T.; Shigeno, M.; Makino, M.; Murakami, M. *Org. Lett.* **2006**, *8*, 3379.
doi: [10.1021/o1061359g](https://doi.org/10.1021/o1061359g)

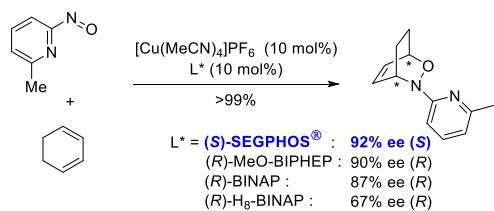
3.4 Double [2 + 2 + 2] Cycloaddition



Nishida, G.; Ogaki, S.; Yusa, Y.; Yokozawa, T.; Noguchi, K.; Tanaka, K. *Org. Lett.* **2008**, *10*, 2849.
doi: [10.1021/o1801013v](https://doi.org/10.1021/o1801013v)

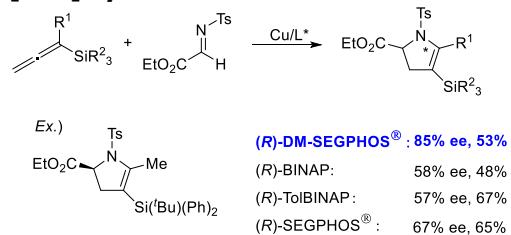
4 Cu Catalyzed Asymmetric Reaction

4.1 Nitroso-Diels-Alder Reaction



Yamamoto, Y.; Yamamoto, H. *J. Am. Chem. Soc.* **2004**, *126*, 4128.
doi: [10.1021/ja049849w](https://doi.org/10.1021/ja049849w)

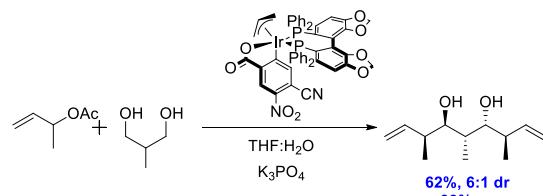
4.2 Cu Catalyzed Asymmetric Reaction: [3+2] Cycloaddition



Daidouji, K.; Fuchibe, K.; Akiyama, T. *Org. Lett.* **2005**, *7*, 1051.
doi: [10.1021/o1047343c](https://doi.org/10.1021/o1047343c)

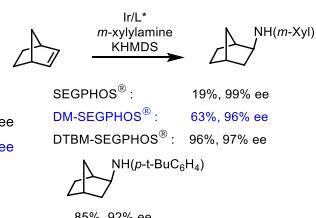
5 Ir Catalyzed Asymmetric Reaction

5.1 Crotylation of 1,3-Diols



Krische, M. J. et al, *J. Am. Chem. Soc.*, **2011**, *133*, 12795.
doi: [10.1021/ja204570w](https://doi.org/10.1021/ja204570w)

5.2 Asymmetric Hydroamination



Zhou, J.; Hartwig, J. F. *J. Am. Chem. Soc.* **2008**, *130*, 12220.
doi: [10.1021/ja803523z](https://doi.org/10.1021/ja803523z)