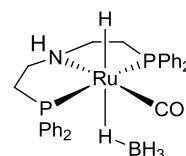
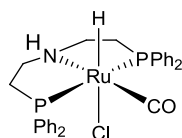


Ru-MACHO®

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*.

"Ru-MACHO" is a registered trademark or a trademark of Takasago International Corporation in Japan and other countries.

Ru-MACHO		Ru-MACHO-BH	
CAS No.	1295649-40-9	CAS No.	1295649-41-0
Formula	C ₂₉ H ₃₀ ClNOP ₂ Ru	Formula	C ₂₉ H ₃₄ BNOP ₂ Ru
M.W.	607.03	M.W.	586.41

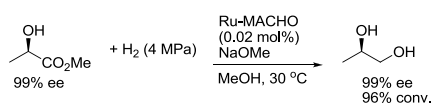


Kuriyama, W. et al. *Org. Process Res. Dev.*, **2012**, *16*, 166. doi : [10.1021/op200234j](https://doi.org/10.1021/op200234j)

PCT Int. Appl. [WO2011048727A](https://pubs.uspto.gov/pat/wo/2011/048727A) (Takasago)

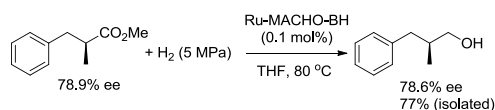
Tech Note

1 Hydrogenation of α -Hydroxy ester

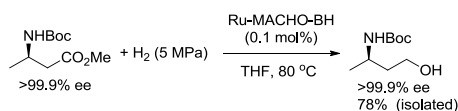
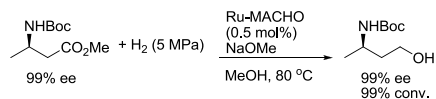


Kuriyama, T.; Matsumoto, T.; Ogata, T.; Ino, Y.; Aoki, K.; Tanaka, S.; Ishida, K.; Sayo, N.; Saito, T. *Org. Process Res. Dev.*, **2012**, *16*, 166. doi : [10.1021/op200234j](https://doi.org/10.1021/op200234j)

2 Hydrogenation of α -Alkyl ester



3 Hydrogenation of Boc-amino esters

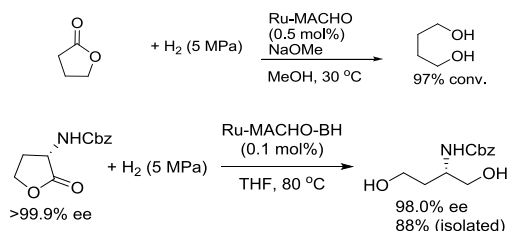


Sayo, N. In Novel Chiral Chemistries JAPAN 2012 (NCC Japan) Conference: Tokyo, Japan, March 15–16, 2012; p117 (book of abstracts).

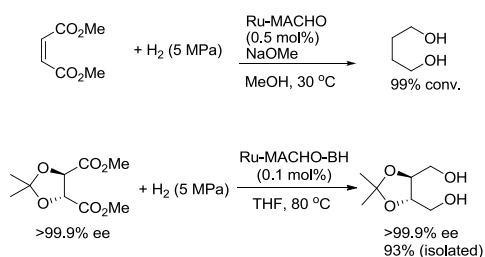


finechemicals@takasago.com

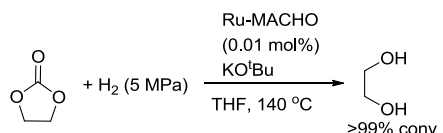
4 Hydrogenation of Lactones



5. Hydrogenation of Diesters

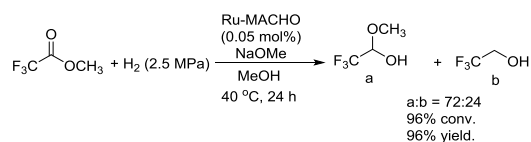


6. Hydrogenation of ethylene carbonate



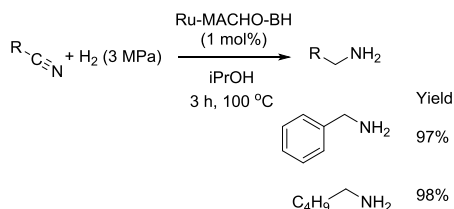
Han, Z. *Angew. Chem. Int. Ed.* **2012**, *51*, 13041.
doi: [10.1002/anie.201207781](https://doi.org/10.1002/anie.201207781)

7. Hydrogenation of Methyl Trifluoroacetate



Dub. P. A. *Organometallics* **2015**, *34*, 4464.
doi: [10.1021/acs.organomet.5b00432](https://doi.org/10.1021/acs.organomet.5b00432)

8. Hydrogenation of Nitriles



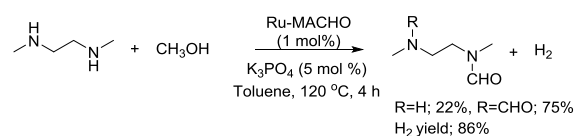
Neumann, J. *Eur. J. Org. Chem.* **2015**, *80*, 5944.
doi: [10.1002/ejoc.201501007](https://doi.org/10.1002/ejoc.201501007)

9. Hydrogenation of Gaseous CO₂ to Methanol



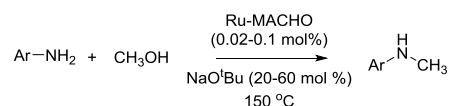
Kothandaraman, J. *J. Am. Chem. Soc.*, **2016**, *138*, 778. doi: [10.1021/jacs.5b12354](https://doi.org/10.1021/jacs.5b12354)

10. Dehydrogenative Coupling of Amine and Methanol (Hydrogen Storage System)



Kothandaraman, J. *J. Am. Chem. Soc.*, **2017**, *139*, 2549. doi: [10.1021/jacs.6b11637](https://doi.org/10.1021/jacs.6b11637)

11. N-Monomethylation of Aromatic Amines with Methanol



Ogata, T.; Nara, H.; Fujiwara, M.; Matsumura, K.; Kayaki, Y. *Org. Lett.* **2018**, *20*, 3866-3870.

doi: [10.1021/acs.orglett.8b01449](https://doi.org/10.1021/acs.orglett.8b01449)

PCT Int. Appl. [WO2014136374A](https://doi.org/10.1021/2014136374A) (Takasago)

12. Oxidation

PCT Int. Appl. [WO2012144650A](https://doi.org/10.1021/2012144650A) (Takasago)

13. From Amide to Amine

PCT Int. Appl. [WO2012039098A](https://doi.org/10.1021/2012039098A) (Takasago)