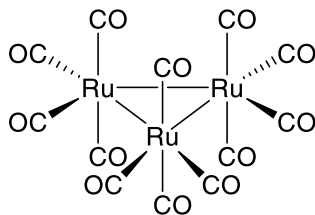


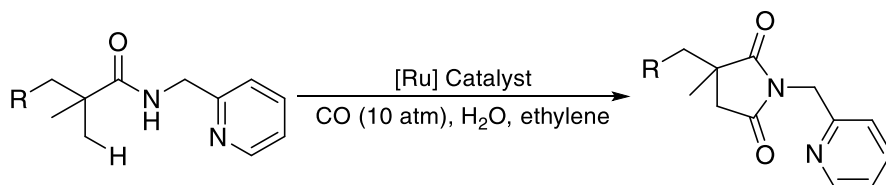
Catalog # 44-1850 Ruthenium carbonyl, 99%



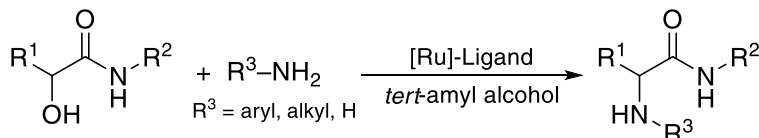
### Catalysis Applications

#### Technical Notes:

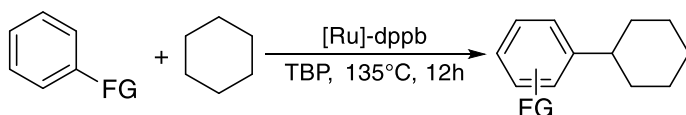
- 1. Carbonylation:** Catalyst for highly regioselective carbonylation of unactivated C(sp<sup>3</sup>)-H bonds
- 2. Amination:** Catalyst for amination of  $\alpha$ -hydroxy amides to generate  $\alpha$ -amino acid amides
- 3. Cross-Coupling:** Catalyst for para-selective oxidative cross-coupling of arenes and cycloalkanes
- 4. Asymmetric Hydrogenation:** Catalyst for asymmetric transfer hydrogenation of ketones
- 5. Pyrrole Synthesis:** Used in the three-component synthesis of pyrroles
- 6. Hydroformylation:** Catalyst for hydroformylation/reduction of olefins to alcohols
- 7. Halogenation:** Used in Ru-catalyzed intermolecular halogenations of arenes via C-H activation
- 8. Nitration:** Catalyst for meta-selective C<sub>Ar</sub>-H nitration of arenes
- 9. Decarboxylative Acylation:** Catalyst for direct decarboxylative meta-selective acylation of arenes
- 10. Cross-Coupling:** Catalyst for cross-coupling of anilines with organoboranes by selective carbon-nitrogen cleavage
- 11. Carbonylative Coupling:** Catalyst for carbonylative coupling of anilines with organoboranes by the cleavage of neutral aryl C-N bond
- 12. Dehydrogenation:** Used in Ru-catalyzed dehydrogenation through an intermolecular hydrogen atom transfer mechanism



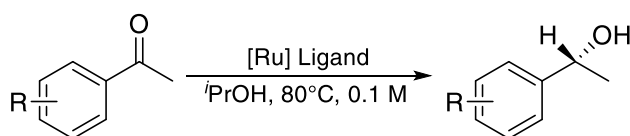
Tech Note (1)  
Ref. (1)



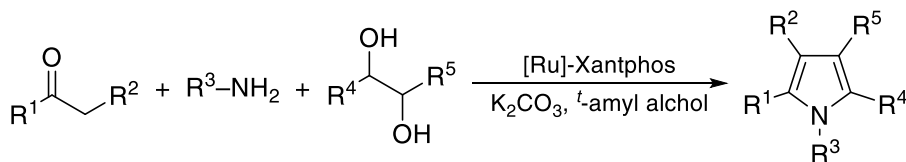
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Ref. (2)



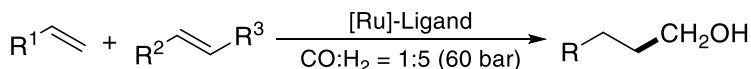
Tech Note (3)  
Ref. (3)



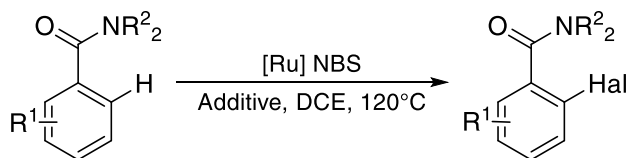
Tech Note (4)  
Ref. (4)



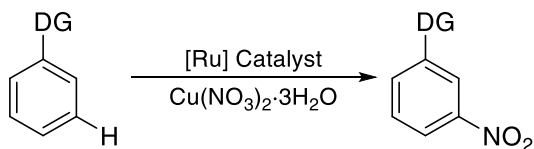
Tech Note (5)  
Ref. (5)



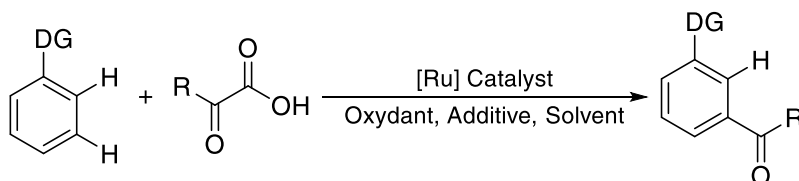
Tech Note (6)  
Ref. (6)



Tech Note (7)  
Ref. (7)

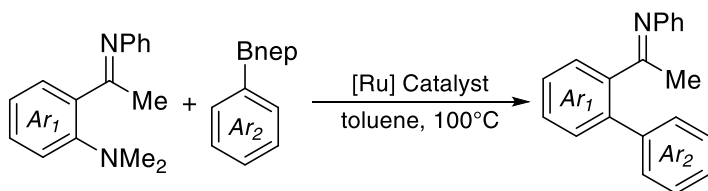


Tech Note (8)  
Ref. (8)

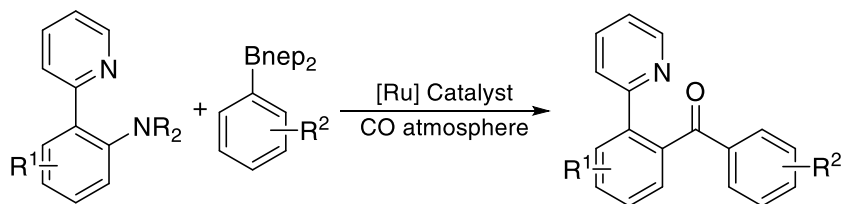


Tech Note (9)  
Ref. (9)

DG = Pyridine, pyrimidine, pyrazole, purine



Tech Note (10)  
Ref. (10)



Tech Note (11)  
Ref. (11)

## References:

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3. [Org. Lett. 2011, 13, 4977.](#)
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7. [Chem. Commun., 2014, 50, 1083.](#)
8. [J. Am. Chem. Soc. 2016, 138, 8470.](#)
9. [ACS Catal. 2018, 8, 11875.](#)
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11. [Org. Lett. 2020, 22, 2756.](#)

### CVD/ALD Applications

#### Thermal Behavior:

- Melting point: 150°C (decomposes) [1]
- TGA diagram is available in [2]
- Vapor pressure: 0.003 Torr/40°C [1, 3]
- Sublimation conditions: 93°C/0.05 Torr [4], 82°C/0.22 Torr [7]

#### Technical Notes:

1. ALD/CVD precursor for Ru thin films

Target Deposit	Deposition Technique	Delivery Temperature	Pressure	Co-reactants	Deposition Temperature	Ref.
Ru	CVD	93°C	0.05 Torr	-	150°C	4
	CVD	70°C, 85°C	0.05 Torr	NH <sub>3</sub>	175; 130-225°C	5-6
Ru(P)	CVD	82°C	0.22 Torr	PMe <sub>3</sub> , PPh <sub>3</sub> , H <sub>2</sub>	200-300°C	7, 8
Ru(B)	CVD	85°C	0.11 Torr	B <sub>2</sub> H <sub>6</sub> , H <sub>2</sub>	250°C	9

#### References:

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2. [Appl. Organometal. Chem. 2009, 23, 196.](#)
3. [J. Phase Equilibria 1999, 20, 565.](#)
4. [Appl. Phys. Lett. 2004, 84, 1380.](#)
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7. [J. Vac. Sci. Technol. A, 2008, 26, 974.](#)
8. [Thin Solid Films 2017, 622, 56.](#)