

Special Topic G: Precious Metal Catalysis

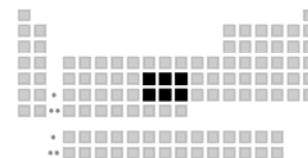


Table G.1 Homogeneous vs. heterogeneous catalysis

	Homogeneous	Heterogeneous
Form	Soluble metal complexes, usually mononuclear	Metals, usually supported, or metal oxides
Phase	Liquid	Gas/solid
Temperature	Low (<250°C)	High (250 – 500°C)
Activity	Moderate	High
Selectivity	High	Low
Diffusion	Facile	Can be very important
Heat transfer	Facile	Can be problematic
Product separation	Generally problematic	Facile
Catalyst recycle	Expensive	Simple
Reaction mechanisms	Reasonably well understood	Poorly understood

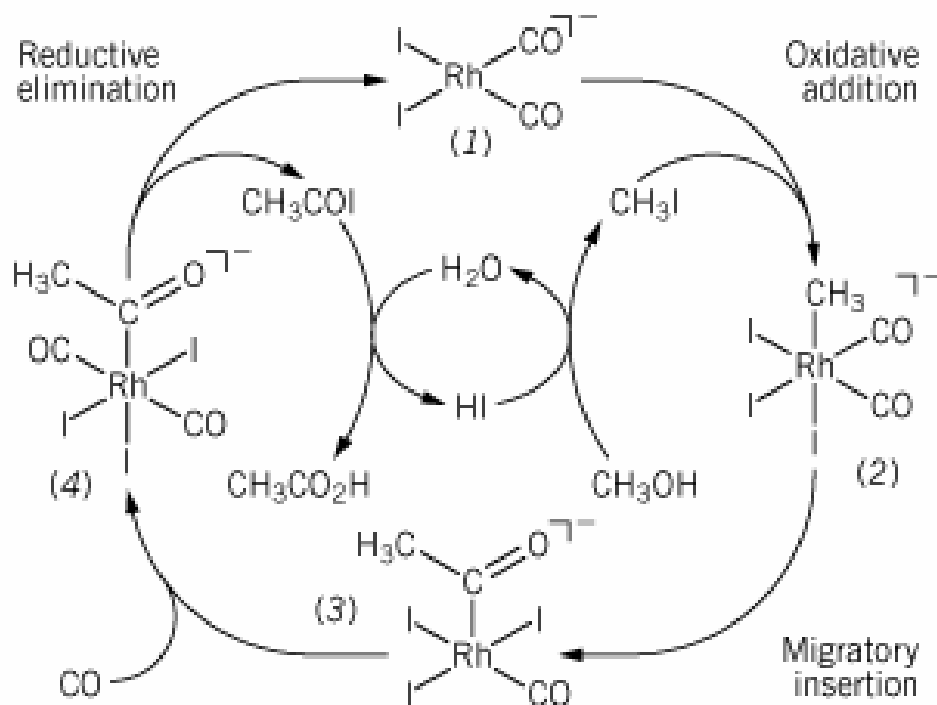


Figure G.1 Simplified reaction mechanism of the Monsanto process for the carbonylation of methanol to acetic acid.

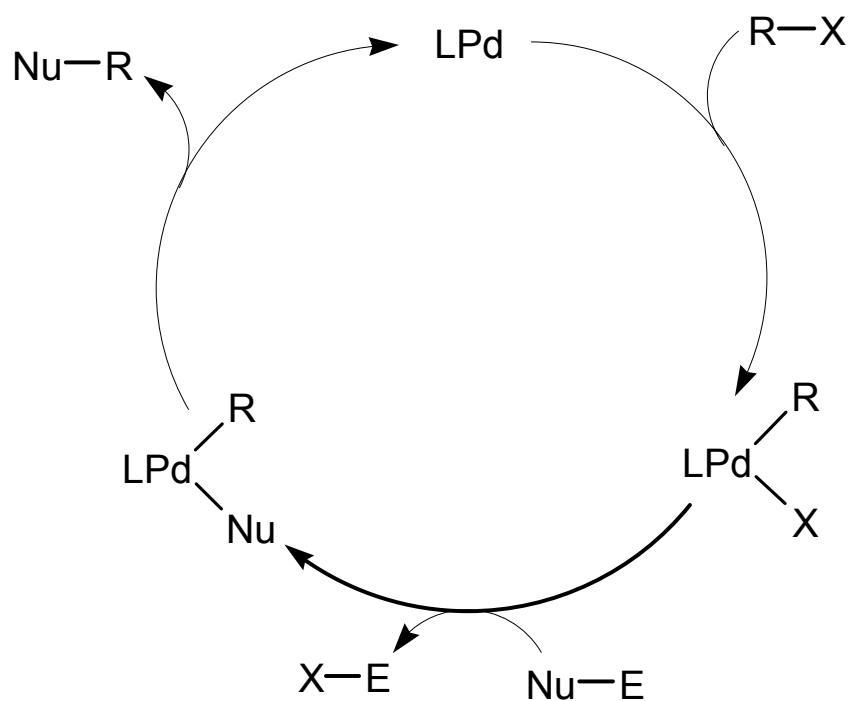


Figure G.2 A schematic mechanism for the Suzuki ($R = \text{aryl or vinyl}$, $\text{Nu} = \text{aryl}$, $E = \text{B}(\text{OH})_2$), Stille ($R = \text{aryl or vinyl}$, $\text{Nu} = \text{aryl}$, $E = \text{SnR}'_3$) and Hartwig-Buchwald ($R = \text{aryl or vinyl}$, $\text{Nu} = \text{NR}'_2$, $E = \text{H}$) coupling reactions.

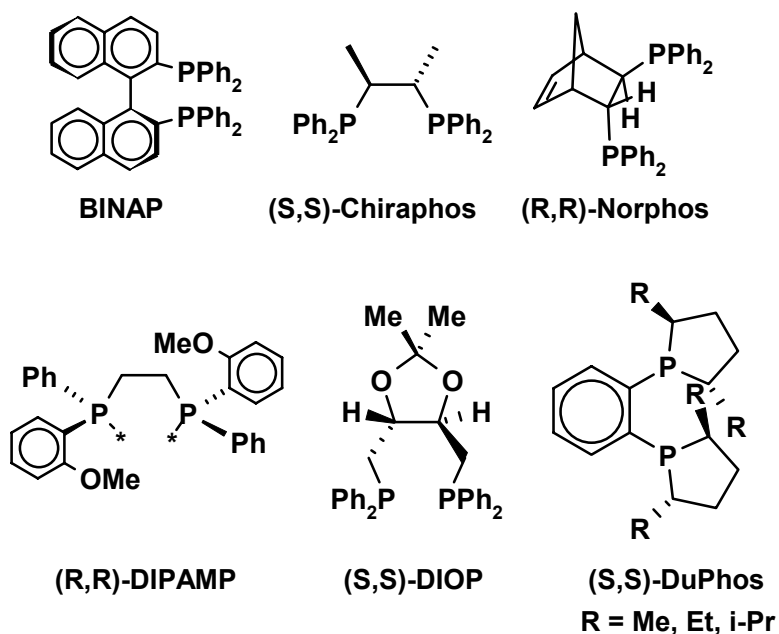


Figure G.3 Some chiral diphosphines which enable asymmetric induction during alkene hydrogenation.