Homogeneous Catalysis

18-electron rule- Metal Carbonyls-Bonding- Nitrosyls-dinitrogen complexes-Phosphines-Phosphines and Phosphites- Electronic- Seric effects- Cone Angle- Metal Alkyls, Aryls, Hydrides and dihydrogen complexes- π- Bound Ligands- Metallocenes-Electronic Structure and Properties-Fischer and Schrock Carbenes -Bonding & Reactivity- Grubbs catalyst

Reaction Mechanism and Catalysis: Ligand substitution- Oxidative Addition and Reductive Elimination- 1,1 and 1,2-Insertion- Addition and Elimination Reactions- Nucleophilic attack on a coordinated Ligand- Energy considerations -Alkene isomerization- Hydroboration-Hydrocyanation- Asymmetric Hydrogenation of olefins- Wilkinson's catalyst-Hydroformylation of olefins- Wacker-smidt Synthesis- Monsanto Acetic Acid process- - BASF process - Water - Gas Shift reaction - Fischer - Tropsch Reaction - Eastman Halcon process-Fischer-Tropsch process- hydrosilylation.

C-H and C-C activation- Alkene Metathesis-Mechanism- ROMP, SHOP and ADMET- C-H bond Activation-Ziegler-Natta Polymerization of olefins-Telomerization Metallocene catalysts -sigma bond metathesis - Diels -Alder Reaction- Isomeration of Alkenes- Oligomerization - Hydrocyanation - Wacker oxidation - Metal catalyzed liquid phase autoxidation - Asymmetric Catalysis - hydrogeneation- isomerization-epoxidation-hydrolyis - Nitroaldol condensation -

Noyori asymmetric hydrogenation - metal mediated C-C and C-X coupling reactions - Heck, Stille, Suzuki, Negishi and Sonogashira, Nozaki-Hiyama, Buchwald-Hartwig, Murai reaction-Ullmann coupling reactions - directed ortho metalation - metal (Rh, Ir) catalyzed C-H activation reactions and their synthetic utility - copper and rhodium based carbene and nitrene complexes - cyclopropanation - Rh catalyzed C-H insertion and aziridination reactions including asymmetric version - introduction to N-heterocyclic carbene metal complexes.

Chemical Industry and Homogeneous Catalysis- Feed Stocks and Defininitions- Reactor Design - Stirred Tank- Tubular-Membrane reactors - Mass transfer & Heat Transfer in multiphase reactions - Catalyst recovery - Effluent & Waste disposal-Heterogenization or immobilization - Biocatalysis and Enzyme- immobilzation methods- Cytochrome P450 - Catalysis under super critical conditions - Ferrocene as a Gasoline and Fuel Additive -

Text Books:

1. Homogeneous Catalysis- Mechanisms and Industrial Applications, Sumit Bhadhuri, Doble Mukesh, Wiley - Interscience, 2000
2. G.O. Spessard and G. L. Miessler, Organometallic Chemistry, 2nd Edn, Oxford University press
3. R.H. Crabtree, The Organometallic Chemistry of Transition Metals, 4th Edn Wiley-VCH

References:

1. Applied Homogeneous Catalysis with Organometallic Compounds, 2nd Edm, Boy Cornliss, Wolgang A. Herrmann, Ed, Wiley - VCH, 2002
2. Homogeneous Catalysis- Understanding the Art, Piet W. N M. van Leeuwen, Kluwer Academic Pub, 2004
3. C. Elschenbroich, Organometallics, 3rd Edn, Wiely VCH

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