

Introduction to Organometallic Chemistry - Video course

COURSE OUTLINE

Introduction to Organometallic Chemistry: This course deals with structure, bonding and reactivity of organometallic compounds: compounds that feature a metal carbon bond. Teaching organometallic chemistry is a daunting task for the instructor. A number of new concepts have to be introduced in the very first lecture. This happens because simple bonding models that help one understand organic compounds and metal complexes do not explain the structures and reactivity of many organometallic compounds and several new bonding models developed and refined in the last fifty years have to be suddenly thrust on the hapless student. Meanwhile, synthesis of new organometallic compounds continue unabated and have led to the study and discovery of fascinating reactions. Many of these reactions and compounds, having no similarity to what the student has been exposed to in organic chemistry giving the student no option but to memorize. So what is the best way to handle this problem?

Given the diversity of “organic compounds”, and the number of “transition metals”, it is obvious that combination of these two classes will lead to a very large “chemical space” which could be presented in various ways. One could base the chemistry of organometallic compounds on the organic ligands that are involved. Or it could be presented with a primary focus on the metal centre. Sometimes, the study is centered around the reaction types. But no method is perfect.

In this course an attempt is made to develop organometallic chemistry in a graded fashion, assuming only a basic understanding of organic and inorganic chemistry that one is exposed to in an undergraduate course. As much as possible, the complexity of carbon ligands attached to the metal is increased gradually. Similarly, simple reactions are dealt with first; those that do not involve a change in the oxidation state of the metal. Subsequently more complex reactions with changes in the oxidation state are taken up along with increase in the hapticity of the ligand. In the experience of the author interweaving structures and reactions, keeps the excitement of the student without leading to frustration and leading to excessive demands on memorization of complex reactions or structures.

COURSE DETAIL



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Chemistry and Biochemistry

Pre-requisites:

Basic Inorganic and Organic Chemistry

Additional Reading:

COMPREHENSIVE ORGANOMETALLIC CHEMISTRY II, 14-VOLUME SET, by E.W. Abel, University of Exeter, UK G. Wilkinson, Imperial College of Science, Technology & Medicine, UK F.G.A. Stone, Baylor University, USA Elsevier

Hyperlinks:

The Organometallic HyperTextBook Index

Coordinators:

Prof. A.G. Samuelson
Department of Inorganic and Physical Chemistry IISc
Bangalore

Module No.	Topics
1.	INTRODUCTION
	1.Introduction To Organometallic Chemistry
2.	C1 LIGANDS AND SIMPLE REACTIONS
	02. Metal carbonyl complexes 03. Metal carbonyls –Part II 04. Ligand substitution reactions 05. Substitutes for carbonyl ligands 06. Carbene complexes 07. Carbene complexes continued 08. Non-Carbon Ancillary ligands 09. Non-Carbon Ancillary ligands continued 10. Metal alkyl complexes 11. Ligand Insertion Reactions
3.	η_m (m=even) ligands
	12. Metal alkene complexes 13. Alkynes η^2 bonding 14. Metal dihydrogen and hydrides 15. Migratory Insertion reaction with alkynes 16. η_m (m=4 dienes and m=2n, polyenes)
4.	Reactions with oxidation state change
	17. Oxidative addition & Vaska's complex mechanism 18. Reductive elimination 19. Reductive Elimination mechanism 20. Oxidative coupling with C-C bond formation 21. Metathesis reactions
5.	η_m (m=odd) ligands
	22. Metal-allyls - η^3 complexes- synthesis, bonding

	23. Metal-allyls - η^3 complexes- fluxionality, reactivity 24. C-C single bond forming reactions
6.	Metalloenes
	25. η^5 Cyclopentadienyl - complexes 26. η^6 arene Metal complexes 27. Half sandwich complexes 28. Reactivity changes in coordinated ligands
7.	Dynamics and structures of organometallic compounds
	29. The isolobal analogy 30. Fluxional Properties of Organometallics 31. Quantifying Steric and electronic factors
8.	Useful catalytic and Stoichiometric reactions
	32. Hydrogenation reactions 33. Addition of HX to olefins 34. Reactions with CO insertion 35. Organometallics promoted C-X coupling 36. Organometallic polymerization 37. C-H activation
9.	Applications of organometallic chemistry
	38. Asymmetric Catalysis 39. Medicinal applications of organometallic complexes 40. Special Properties and Applications

References:

Title: Organometallics: A Concise Introduction

Authors: Christoph Elschenbroich

Year: 2006

Publisher:Wiley-VCH3rd Edition

ISBN-13:978-3-527-29390-2

Title:Basic Organometallic Chemistry:Concepts, Syntheses and Application

Authors:BD Gupta & Anil J Elias Year:2013

Publisher:Universities Press

ISBN:978-81-7371-709-3

Title:Fundamentals of Organometallic Catalysis

Author:Dirk Steinborn

Year:2012

Publisher:Wiley-VCH

ISBN:978-3-527-32717-1

Title:Organometallic Chemistry and Catalysis

Author:Didier Astruc

Year:2007

Publisher:Springer

ISBN:978-3-540-46129-6