

# Organometallics: Applications in Material Science and Drug Discovery

Under the aegis of MHRD—Global Initiative of Academic Networks

URL: <http://iiti.ac.in/GIAN/>

## Overview

Prominent catalytic reactions such as alkene and alkyne metathesis, selective catalytic bond formation by palladium catalysis or C-H activation are the basis for modern organometallic chemistry important for the efficient synthesis of medicinally important compounds as well as for novel functionalized materials. After an introduction including the history of organometallic chemistry, practical aspects as well as the application of instrumental analytics to organometallic compounds main group organometallics will be discussed with an emphasis on the guiding principles and modern developments. *Inter alia* these include superbases as well as a section on superactive metals. Selective reactions of organo-main group metals for the drug discovery will be presented. Fundamental principles to Catalytic C-H activation will be presented on the basis of newest developments.

The second part of the course is devoted to transition metal organic chemistry and starts with *Organometallics in Catalysis to Nonlinear Optics, Solar Cells and OLEDs*. Carbene complexes will be discussed as the basis for the construction of important organic compounds by the Dötz reaction. Special lectures will emphasize alkene metathesis and catalytic alkyne cyclotrimerization on the synthesis of modern materials and medicinally important compounds such as vitamins or steroids. Aspects of molecular electronics will be presented in the chemistry of metal based molecular wires. Metallocenes and their applications as asymmetric catalysts for various selective bond forming reactions will conclude the course.

The primary objectives of the course are as follows:

- 1) Understanding the importance of organometallic chemistry for modern efficient and selective synthesis
- 2) Understanding of organometallic chemistry in Catalysis, Synthesis of Natural Product and Drug Discovery.
- 3) A perspective on current and future applications of Organic Electronics in day to day life where organometallics plays a major role such as Organic Light emitting diodes (OLEDs) and molecular wires.
- 4) Knowledge of important catalytic reactions and their applications to organic chemistry including alkene metathesis, catalytic coupling reactions, C-H activation, stereoselective reduction etc.
- 5) Understanding the Multi-photon absorption phenomena and optical limiting behaviours of organometallic compounds, which can be used for protection of highly sensitive sensors and human eye.
- 6) Understanding the importance of energy, where organometallic compounds play a major role in solar cells (dyes sensitized solar cells / bulk heterojunction solar cells).

## Schedule of the Course

<b>Schedule of the course</b>	: Nov 22 –Dec 02, 2016
<b>Total Number of days/lectures</b>	: 10 days / 10 lectures and 10 tutorials

## Registration Fee

<b>Participant from outside India</b>	: USD 500
<b>Industry/ Business organization</b>	: Rs. 20,000
<b>Academic Institutions</b>	: Rs. 8,000
<b>Students</b>	: Rs. 5,000

The fee includes all instructional materials, computer use for tutorials, internet facility. The participants will be provided with accommodation on payment basis. Limited seats are available in IIT Indore hostel on payment and first come first serve basis

## Topics Covered

*Organometallics: Basis for many Nobel prizes, Organo Main group Metals Part 1: Use in Asymmetric Synthesis, Drug Design and Discovery, Organo Main group Metals Part 2: Applications in Polymer Synthesis and more..., Organoboron compounds for cancer treatment: Boron Neutron Capture Therapy, C-H activation: Principles and Applications in Organic Synthesis Organometallics in Catalysis: Carbene Complexes in Catalysis and Industrial Polymer Synthesis Catalytic alkyne [2+2+2] cyclization for the synthesis of natural products and novel materials: Organometallics in Organic light emitting diodes (OLEDs), Organometallics in Nonlinear Optics: Second and Third order Nonlinear Optical behaviour, Multi-Photon absorption and Optical limiting, Molecular Wires: Organometallics in Molecular Electronics, Organometallics in Solar Cells: Dye Sensitized Solar Cells and Bulk Heterojunction Solar cells*

## Faculty Information

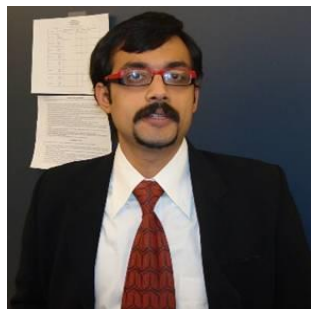


### Teaching Faculty

**The course will be delivered by Professor Dr. Holger Butenschön, Leibniz Universität Hannover, Germany.**

**Prof. Dr. Holger Butenschön** obtained his scientific education at the University of Hamburg (Germany) and obtained his Dr. rer. nat. degree with Prof. Dr. Armin de Meijere in 1983 with research on a cross conjugated hydrocarbon as fellow of the Studienstiftung des Deutschen Volkes. Prof. Butenschön then joined the group of Pro. Dr. K. P. C. Vollhardt at the University of California at Berkeley as a NATO-DAAD postdoctoral fellow performing research on cobalt catalyzed [2+2+2] alkyne cyclizations. Prof. Butenschön performed independent research at the Max-Planck-Institute für Kohlenforschung under Prof. Dr. G. Wilke as the director as a FCI Liebig Fellow. This research focuses on the chemistry of benzocyclobutene tricarbonylchromium complexes and on cyclopentadienylcobalt complexes with a chelating phosphane tether. After his Habilitation in 1992 Prof. Butenschön was a DFG Heisenberg Fellow at the University of Wuppertal, and in 1993 he accepted a call as University Professor at the Leibniz Universität Hannover. In 1999 Prof. Butenschön was a Foreign Visiting Professor at Kyushu University in Fukuoka (Japan). In 2000 he was the Karcher Lecturer at the University of Oklahoma at Norman. In 2008 he was a Visiting Professor at the

University of California at Berkeley. Having served as Dean of the Faculty of Chemistry 2004-2005 he has been a member and the speaker of the Senate of the Leibniz Universität Hannover since 2011. Prof. Butenschön served in a number of functions in the German Chemical Society (GDCh).



#### **Co-ordinating Faculty**

**Dr. Rajneesh Misra**, Dr. Rajneesh Misra obtained his Masters from University of Gorakhpur, India in 2001. He moved to IITK, Kanpur, for his Ph.D (2007) in Chemical Sciences. After two successive postdoctoral stays at GATECH, Atlanta, USA from 2007-2008 and University of Kyoto, Japan from 2008- 2009, he joined IIT-Indore, India in 2009 as an Assistant Professor. In 2013 he was promoted as an Associate Professor. His research interest lies in the areas of Organic Photonics and Organic Electronics.

### **Who should attend this course?**

1. Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories.
2. Undergraduates, M.Sc, and PhD science stream students. Any student with a basic chemistry background will be able to follow these lectures and gain a lot from them.
3. B.Sc and M.Sc level teachers who wish to update their organometallic chemistry knowledge.

### **Course Co-ordinator**

**For any further information and registration, please contact:**

**Dr. Rajneesh Misra**

*Associate Professor*

Discipline of Chemistry

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