Chemistry of Materials - Web course

COURSE OUTLINE

The proposed course in intended to fill the gap between students who are from science background during their (10+2) and aspiring to pursue engineering studies.

Some of the topics cover more advanced techniques which can be understood by basics of physics and chemistry they studied during their high school. In this course on chemistry of materials, we intend to introduce basic understanding of materials that has been used in today's technology.

By the end of this lecture course, reader would get basic idea about the understanding of physical properties of materials, their synthesis and basic characterization. Apart from basic characterization, we introduce in module 4 and 5, few advanced concepts on fabrication of devices and their characterizations.

COURSE DETAIL

Module No.	Topic/s	Lectures
1	**Introduction to materials** • Inorganic Materials • organic materials • Nanotechnology 1. Periodic table – physical and chemical properties of elements 2. Introduction to solid state chemistry -1 3. Introduction to solid state chemistry - 2 4. Carbon chemistry – physical and chemical properties 5. Bulk to nano transition - physical phenomena, 3D, 2D, 1D, OD nano systems 6. Introduction to nanoscience and nanotechnology – Metals, semiconductors 7. Introduction to nanoscience and nanotechnology – Carbon nanotubes, fullerenes 8. Quantum dots	8
2	**Systems under technological importance** 1. Naturally occurring materials 2. Optical and magnetic systems based on Metals 3. Inorganic semiconductors - Optical materials – 1 4. Inorganic semiconductors –Magnetic materials – 2	13

NPTEL

http://nptel.iitm.ac.in

Chemistry and Biochemistry

Pre-requisites:

(10+2) students with science (Mathematics, Chemistry, Physics) background.

Coordinators:

Dr. M. Quereshi
Department of ChemistryIIT Guwahati

	5. Organic semiconductors – Optoelectronic materials - 1 6. Organic semiconductors – Optoelectronic materials – 2 7. Self assemblies of nano particles 8. Nano systems – catalysis 9. Surface coating technology 10. High temperature superconductivity 11. Application of high temperature superconductivity 12. Complex metal oxides 13. Giant magneto resistance, Spintronics	
3	**Chemical and non – chemical approach to materials synthesis** 1. Solution based material synthesis – Precipitation methods, hydrothermal etc., 2. Solution based materials synthesis - Micro – emulsion ,Sol – gel, Phase transfer reactions 3. Synthesis and properties of monolayer capped metal nanoparticles 4. Material synthesis using microwave radiation and ultra sonic waves 5. Solid state synthesis 6. Hybrid methods for materials synthesis – synthesis of rational shaped molecules and semiconductors	6
4	**Fabrication techniques based on solution and depositions.** **Example:** • PLD • MBE • Sputtering • CVD • MOCVD etc. 1. Fabrication techniques - Pulsed laser Deposition 2. Fabrication techniques – Pulsed Electron Deposition 3. Molecular Beam Epitaxy 4. Magnetron Sputtering 5. Chemical Vapor deposition 6. Metal – organic chemical vapor deposition	6
5	**Modern Characterization of materials** **Example:**	7

	• SEM • TEM • XPS – UPS • AFM – SPM • powder X – ray Etc. 1. Routine characterization tools – UV –visible spectrophotometer, Fluorimeter, NMR, IR, Particle size analyzer 2. Powder X – ray microscopy 3. Scanning electron microscopy 4. Transmission electron microscopy 5. X – ray photoelectron spectroscopy 6. Atomic force microscopy – Scanning probe microscopy 7. Electron beam lithography	
6	**Conclusions**	1

References:

1. J. D. Lee, Concise Inorganic Chemistry, , Fifth edition, Blackwell publishing, 2008.
2. Robert T. Morrison, Robert N. Boyd, and Robert K. Boyd, Organic Chemistry, 6th edition Benjamin Cummings, 1992.
3. Charles P. Poole Jr. Frank J. Owens, Introduction to Nanotechnology, John Wiley & Sons, Inc. 2003.
4. Nan Yao, Zong Lin Wang, Handbook of Microscopy for Nanotechnology, Kluwer academic publishers, London, 2005.