

Course Outline for Materials Chemistry
D. Khushalani

Timings: Tue and Thur 10:00 am to 11:30pm

Part 1

Part A: Introduction to Materials Chemistry

Part B: Physical Characterization Techniques

1. X-ray diffraction (single crystal and Powder)
2. Optical and Electron Microscopy (TEM and SEM)
3. Surface Analysis: Surface Probe Microscopy (STM, AFM)
4. Surface Area and Thermal Analysis: BET and TGA, DTA and DSC

Part 2

Part A: Introduction

1. Size Dependant Aspects, Hierarchy, Size length scales, (Why Nano? (bulk vs clusters vs nanosized); Basics of Solid State Chemistry; Bio-inspiration
2. Top-Down vs. Bottom-up Approach

Part B: Synthesis & Application

1. Biomimicry/Biomineralization
2. Self Assembly, SAMs, DNA Origami
3. Soft Lithography
4. Chemical Synthesis of Nanoparticles, Nanorods, Nanospheres, Thin films, core-shell structures etc. (*concentrating on Inorganic Solids*)
5. Templating effect – amphiphiles, proteins, block copolymers
6. Reticulated structures – ie. Porous solids and formation of void cavities (early history of zeolites to novel porous metals)
7. Photonic crystals
8. Applications: Materials Science for Energy capture, storage and conversion
9. Environmental Issues

Reading Materials:

Solid State Chemistry and Its Applications – Anthony West

Solid State Chemistry Techniques – Ed AK Cheetham and Peter Day

Electronic Structure and Chemistry of Solids – PA Cox

Evaluation

1. Mid-term exam: 30%
2. 4 Assignments: 20%
3. Final Exam: 50%