



Solid state and Material Science

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
CHM	447	Solid state and Material Science	4	4	0	0	CHM 343

Objectives:

By the completion of this course, students will be expected to:

- Predict basic physical properties of materials based on knowledge of their atomic composition and chemical bonding.
- Readily describe the structure of crystalline materials using the nomenclature of Bravais lattices and Miller Indices.
- Use a binary phase diagram to quantitatively describe the compositions, phases and microstructures developed during heat treatments of binary solid systems.
- Use the principles of nucleation theory and solid state diffusion to solve problems involving kinetics of phase transformations in metal alloy systems

Syllabus:

Why Solid-State Chemistry. Modern Chemical Concepts and Periodicity of the Elements. The Electron and Light. Atomic Structure. Wave-Particle Duality. Spin and the Multielectron Atom. Electron Transfer and Ionic Bonding. Covalent Bonding.

Periodic Trends and Bonding. Molecular Orbitals. Hybridization and Molecular Geometry. Intermolecular Forces and Materials Properties. Reaction Kinetics. Reaction Mechanisms. Band Theory of Solids . Band Gaps and Optical Properties. Conductivity of Semiconductors.

Crystal Structures. X-Rays and their Generation. Diffraction and Bragg's Law. Bonding and the Mechanical Behavior of Solids. Defects in Solids. Plastic Deformation and Defects .Amorphous Inorganic Solids. Properties of Glasses. Diffusion in Solids.

Time-Dependent Diffusion. Solutions and Chemical Equilibrium. Equilibrium Between Phases. Multicomponent Phase Diagrams. Chemistry of Carbon. Polymer Synthesis.

Polymer Properties. Surface Energy and Surfactants. Molecular Aggregation. Acids and Bases. Amino Acids and Protein Synthesis. Protein Structure and Structural Carbohydrates. Perspective: chemical Bonding and Materials.

Textbook:

Introduction to Solid-State Chemistry published by Pearson Custom Publishing (ISBN 10: 0-558-36407-1), 2009

References:

Materials Science and Engineering: An Introduction, SIXTH EDITION William D. Callister, Jr.

