

CH 540: SOLID STATE CHEMISTRY (3-0-0: 3)

Introduction to Crystals and Lattices

Unit cells, crystal structure, packing, packing efficiency, coordination number, density of packing in simple cubic, BCC CCP, and HCP structure, tetrahedral, and octahedral holes, radius-ratio, Lattice energy. Structures of Rock salt, zinc blende, Wurtzite, rutile and calcite, perovskite and spinels.

Crystal Defects and Non-Stoichiometry

Perfect and imperfect crystals, intrinsic and extrinsic defects - point defects, line and plane defects, vacancies - Schottky defects and Frenkel defects, thermodynamics of Schottky and Frenkel defects formation, colour centres, non-stoichiometry and defects.

Solid State Synthesis

General principles, experimental procedures, high temperature methods, co-precipitation as a precursor to solid state reactions, sol-gel methods, microwave synthesis, high pressure methods for synthesis of solids, kinetics of solid state reactions.

Phase Transformations in Solids

Classification and thermodynamics of phase transformations in solids, first order and second order phase transitions, applications of G-T diagrams, kinetics of phase transformations, nucleation and growth mechanism, experimental methods of study of phase transformations. Phase transformation in metals, alloys and compounds.

Band Structures of Solids

Band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions.

Properties of Solid

Optical properties: Optical reflectance, photoconduction - photoelectric effects. Superconductors and electrically conducting solid, organic charge - transfer complex, organic metals, and magnetic properties - classification of materials. Quantum theory of paramagnetics - cooperative phenomenon, magnetic domains, hysteresis, dielectric, ferroelectric and piezoelectric properties of solids.

Text Books and References:

1. L. E. Smart and E. A. Moore, "Solid State Chemistry: An Introduction", CRC Press.
2. A. R. West, "Solid State Chemistry and its Applications", Wiley Student Edition.
3. C. N. R. Rao, "New Directions in Solid State Chemistry", Cambridge University Press.