Course Title: Solid State Chemistry
Semester: VII
Course Code: CH-480
Credit Hours: 3-0
Pre-requisite: Nil

Course Objectives

1. The solid state includes most of the materials that make basis modern technology. Including the wide varieties of steel that are used in architecture and engineering, the semiconductors and metallic conductors that are used in information technology and power distribution, the ceramics that increasingly are replacing metals because being used in the fabrication of many of the common objects of the modern world. The properties of solids stem, ofcourse, from the arrangement and properties of the constituent atoms, and one of the challengesof this course is to see how a wide range of bulk properties, including rigidity, electrical conductivity, and optical and magnetic properties stem from the properties of atoms. One crucial aspect of this link is the pattern in which the atoms (and molecules) are stacked together, and we emphasis in course on the examination of how the structures of solids are described and determined.

Contents

2. Introduction: solid state chemistry, close packing, hcp, fcc, density, coordinationnumbers, tetrahedral and octahedral holes, body centered and primitive, crystalline solids, fractional coordinates, ionic and covalent solids.
3. Crystal structures of simple solids, polyhedral representation, structure types, cation: anion coordination number, ionic radii, metallic crystals, ionic crystals, interactions between atoms, atomic radii, molecular structures, Types of bonding in solids, Born-Haber Cycle, Latticeenergy.
4. Synthesis. Preparation of single crystals, Czochralski, temperature gradients, flame and plasma fusion, Arc melting, Sintering. Characterization. X-ray diffraction; powder diffraction, destructive interference, corrections, structure factor, indexing peaks, absences due to lattice centering, indexing example, systematic absences, Indexing using software, density map, identification of samples, crystallite size, Debye Scherrer, Rietveld method an introduction, microscopy (SEM/EDX), transmission electron microscopy (TEM), Raman Spectroscopy, Maussbaur Spectroscopy, X-ray absorption spectroscopy, fluorescence. Thermal Analysis (DTA,TGA, DSC),Atomic Force Microscopy (AFM). Solid Materials: Composites, Ceramics, Intermetallics/Alloys. Phase stability: Phase rule. Unary and Binary phase diagrams.

Text Books

5. LesleyE. Smart and Elaine A. Moor, Solid State Chemistry: An Introduction", (3rd Edition, (2005).
R. W. Anthony, Solid State Chemistry and its Applications , John Wiley & Sons, (2014)
6. Recommended Book:
   a. Sandra E. Dann Reactions and Characterization of Solids , The Royal Society ofChemistry, (2000).
   b. R. A. Harry, Introduction to Materials Chemistry , John Wiley & Sons (2008).

Course outcomes

1. After passing this course students will be able to relate the properties of solids with thearrangement of constituent units. Moreover students will be trained to see that how a wide rangeof bulk properties, including rigidity, electrical conductivity, and optical and magnetic properties stem from the properties and the arrangement of atoms. They will get knowledge of crucial characterization techniques along with the introduction to certain solid materials and their applications.