

Introduction to Ceramic Technology

Credits: 4

Unit 1:

Applications of ceramics, classification of ceramics, fine ceramics, Introduction: oxide and non-oxide ceramics, their chemical formulae, Rules for structure formation in oxides/ionic solids, Crystallography: structures and structure determination, Atomic structure and bonding in materials.

Unit 2:

Review of Bonding Characteristics of Ceramics (Madelung Constant, Born-Haber Cycle, Non-Bonding Electron Effects, Crystal Field Effect, Jahn-Teller Distortion) Crystal structure of materials, crystal systems, unit cells and space lattices, determination of structures of simple crystals by x-ray diffraction, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Concept of amorphous, single and polycrystalline structures and their effect on properties of materials.

Unit 3:

Defects and dislocations in ceramics, non-stoichiometry and typical properties, Defects equilibrium, Defects diffusion, Ionic and defect conductivity, Electronic properties of ceramics

Unit 4:

Powder Preparation: Physical methods (different techniques of grinding), chemical routes - co-precipitation, sol-gel, hydrothermal, combustion synthesis, high temperature reaction (solid state reaction).

Unit 5:

Basic principles and techniques of consolidation and shaping of ceramics: powder pressing- uniaxial, biaxial and cold isostatic and hot isostatic, injection moulding,

slip casting, tape-casting, calendaring, multilayering.

Unit 6:

Ceramics for energy and environment technologies (fuel cell, lithium battery, gas sensor and catalytic support)

TEXT BOOKS;

1. Introduction to Ceramics – W.D. Kingery et al – John Wiley
2. FINCER proceedings of workshop on fine ceramics synthesis, properties and applications – T.R. Rammohan et al.
3. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

REFERENCE;

1. Hand Book of Fibre-reinforced composite materials - Ed. Lubin.
2. Fundamentals of Ceramics – M W Barsoum
3. Ceramics – Mechanical Properties, Failure Behaviour, Material Selection – D. Munz & T. Fett
4. Ceramic Science and Technology – Vol. 2 Material Selection and Properties Ed., Ralf Riedel and I-Wei Chen, Wiley -VCH