

AMCT03 MATERIAL SCIENCE

UNIT-1 CHARACTERIZATION OF CERAMIC SOLIDS

- 1.1 Classification of engineering materials- structure-property relationships
- 1.2 Atomic structure- bonding- bond energy, bond type, bond length, ionic, metallic, covalent, vanderwaals, secondary, variation in bonding character and properties
- 1.3 Polymorphic transformations- structure of ceramics- metallic and ceramic structures- binary, ternary, silicate structures.

UNIT-2 STRUCTURE OF SOLIDS AND IMPERFECTIONS

- 2.1 Crystalline and non-crystalline states- inorganic solids- covalent, metals and alloys, ionic, polymers- classification- structure- crystallinity.
- 2.2 Imperfections- point- vacancy, Schottky, Frenkel- Line- dislocations- edge, screw, properties of dislocations- surface - grain boundary, interface boundary, twin and twist boundary, stacking faults- volume imperfections.

UNIT-3 PHASE DIAGRAMS AND PHASE TRANSFORMATIONS

- 3.1 Phase rule- single component system- binary phase diagrams- micro structural changes during cooling- lever rule- applications of phase diagrams- phase transformations
- 3.2 Time scale for phase changes- nucleation & growth- applications.

UNIT-4 DIFFUSION

- 4.1 Fick's laws of Diffusion
- 4.2 Solution to Fick's second law- applications based on the second law solution.
- 4.3 Relationship between diffusibility and atomic mobility.
- 4.4 Atomistic mechanisms of Diffusion- vacancy, interstitial, substitutional, interstitialcy, ring mechanism.
- 4.5 Different types of diffusivities and their interdependence-
- 4.6 Tracer diffusivity, chemical diffusivity etc.
- 4.7 Temperature dependence of diffusivity and activation energy.
- 4.8 Kirkendall effect and Matano interface. Surface and Volume diffusivity.

UNIT-5 PROPERTIES

- 5.1 Physical properties- density, specific gravity, melting behavior.
- 5.2 Thermal Properties- heat capacity, thermal conductivity, and thermal expansion.
- 5.3 Dielectric properties- polarization, dielectric constant, dielectric strength, dielectric loss, capacitance.

References Books:

1. David W Richerdson, Modern Ceramic Engineering, Marcel Dekker Inc, New York, 3rd Edn, 2006.
2. Michael W Barsoum, Fundamentals of Ceramics, McGraw Hill Co, New York.2000.
3. Dr.M.Arumugam, Materials Science, Anuradha Agencies, 2002.