

## **AMCT-04**

## **PROPERTIES OF CERAMICS**

### **OBJECTIVE**

To enable the students to have a thorough knowledge on the different properties of ceramics.

### **OUTCOME**

On completion of the course the students are expected to

- Have a thorough knowledge on the mechanical properties and the mechanical failure modes of ceramics.
- Have studied the thermal properties of ceramics.
- Have an understanding on the optical properties of ceramics.
- Have a better knowledge on electrical properties of ceramics.
- Have a clear understanding on the magnetic properties of ceramics.

### **UNIT I MECHANICAL PROPERTIES**

Plastic deformation of different crystals, creep in single crystal, polycrystal, refractories. Viscous flow of liquids and gases. Elastic moduli, anelasticity, brittle fracture and crack propagation, strength and fracture surface work experience, static fatigue, creep fracture, effects of microstructure.

### **UNIT II THERMAL PROPERTIES**

Heat capacity, density and thermal expansion of glasses, crystals, composite bodies. Thermal conduction – phonon conductivity of single phase crystalline ceramics and glasses, photon conductivity, conductivity of multiphase ceramics, thermal stress, temperature gradients, resistance to thermal shock and thermal spalling, thermal tempering and annealing.

### **UNIT III OPTICAL PROPERTIES**

Introduction, refractive index and dispersion, reflection and refraction, absorption, scattering, polarisability, boundary reflectance and surface gloss, opacity and translucency, absorption and colour, application.

### **UNIT IV ELECTRICAL PROPERTIES**

Electrical conduction phenomena, ionic conduction in crystals and glasses, electronic conduction in crystals and glasses, non-stoichiometry and solute controlled electronic conduction, valency controlled semiconductors, mixed conduction in poor conductors, poly crystalline ceramics, electrical phenomena, dielectric loss factor for crystals and glasses, dielectric conductivity, polycrystalline and polyphase ceramics, dielectric strength.

### **UNIT V MAGNETIC PROPERTIES**

Magnetic phenomena, origin of interactions in ferromagnetic materials, spinel ferrites, rare earth garnets, ortho ferrites and illmenites, hexagonal ferrites, polycrystalline ferrites, susceptibility, permeability, flux density, types of magnetism and their origin, electronic structure and magnetic

moment, exchange interaction and super exchange interaction, hysteresis loop and magnetic domain – domain structure.

#### **TEXT BOOKS**

1. Kingery W.D, Bowen H.K and Uhlmann D.R, Introduction to Ceramics, John Wiley & Sons, 1991.
2. Barsoum M.W, Fundamentals of Ceramics, McGraw-Hill, 1997.

#### **REFERENCES**

1. David W.Richerson, Modern Ceramic Engineering, 3<sup>rd</sup> Edn., Taylor and Francis, 2005.
2. Moulson A.J and Herbert H. M, Electroceramics, Chapman and Hall, London, 1990.
3. Allen Dinsdale, Pottery Science: Materials, Processes and Products, Ellis Horwood Ltd., NY, 1986.