

AMCT14 GLASS ENGINEERING I

UNIT-1 PRINCIPLES OF GLASS FORMATION

- 1.1 Definition. Difference between a glass and crystalline material.
- 1.2 Glass Formation- atomistic hypothesis of glass formation, kinetic approach to glass formation.
- 1.3 Structures of glasses- fundamental laws,
- 1.4 Elements of structural models for glasses, structural models for silicate glasses.
- 1.5 Phase diagrams of glass forming oxide systems- $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$, $\text{Na}_2\text{O-CaO-SiO}_2$ etc.

UNIT-2 RAW MATERIALS AND PREPARATION OF GLASS BATCH

- 2.1 Raw materials- Glass formers, intermediates and modifiers, cullet, minor ingredients like oxidizing/reducing agents, refining agents, decolourisers, colouring oxides
- 2.2 Description and importance.
- 2.3 Selection of glass composition, change in properties in relation to change in composition,
- 2.4 Glass batch calculation.

UNIT-3 GLASS MELTING PROCESS

- 3.1 Physiochemical reactions during glass melting- effect of particle size and pre-sintering on melting.
- 3.2 Refining- sources of gas bubbles, identification of gases, solubility of gases in glass, growth & rise of bubbles, refining agents.
- 3.3 Homogenization- sources of inhomogeneity, rate of homogenization in relation to diffusion kinetics, convection currents & rise of bubbles.
- 3.4 Effect of colourants in glass melting.

UNIT-4 PROPERTIES OF GLASS

- 4.1 Thermodynamic & thermal properties- density, surface tension, thermal expansion, specific heat, thermal conductivity.
- 4.2 Mechanical properties- viscosity, elastic properties, hardness, strength.
- 4.3 Electrical & Transport properties- electrical conductivity, dielectric property, ionic diffusion.
- 4.4 Other properties- refractive index, dispersion, chemical durability.

UNIT-5 TESTING AND QUALITY CONTROL

- 5.1 Flat glass defects- origin, characteristics.
- 5.2 Container glass defects- origin, remedies. .
- 5.3 Test procedures for normal glass and coated glass.

References Books:

1. D.Ganguli, S.Kumar, Elements of Ceramics –Vol II, Indian Institute of Ceramics, 1984.
2. Fundamentals of Glass Manufacturing Process 1991, Proceedings of the First Conference of the European Society of Glass Science and Technology, Society of Glass Technology, 1991.
3. Tooley F.V, Handbook of Glass Manufacture, Vol I&II, Ogden Publishing Co., NY, 1960.