

AMPTE09 POLYMER STRUCTURE AND PROPERTY RELATIONSHIP

UNIT-1 STRUCTURE OF POLYMERS

- 1.1 Linear, branched, crosslinked, and network polymers
- 1.2 Homochain and hetero atomic chain polymers
- 1.3 Copolymers - Linear and cyclic arrangement-
- 1.4 Prediction of polymer properties, group contribution techniques, topological techniques-
- 1.5 Volumetric properties - molar volume, density, Van der Waals volume
- 1.6 Coefficient of linear thermal expansion and volumetric thermal expansion
- 1.7 Pressure volume temperature (PVT) relationship.

UNIT-2 MECHANICAL PROPERTIES

- 2.1 Stress-strain properties of polymers
- 2.2 Effect of polymer structure on modulus of elasticity, tensile strength, flexural strength, impact strength, yield strength, fracture toughness
- 2.3 Crazing in glassy polymers- Ductile brittle transition.
- 2.4 Effect of additives on mechanical properties of polymers
- 2.5 Creep, stress relaxation, and fatigue.

UNIT-3 THERMODYNAMIC AND TRANSITION PROPERTIES

- 3.1 Transition temperature in polymers, glass transition (T_g), melt transition (T_m), relationship between T_g and T_m - other transitions like β -transitions, upper and lower glass transition temperatures
- 3.2 Prediction of T_g and T_m of polymers by group contributions.
- 3.3 Calorimetric properties- Heat capacity, specific heat, latent heat of crystallization and fusion, enthalpy and entropy
- 3.4 Calculation of heat capacities of polymers.

UNIT-4 ELECTRICAL AND OPTICAL PROPERTIES

- 4.1 Effect of polymer structure on dielectric constant, power factor, dissipation factor, and loss factor - effect of frequency of voltage and temperature on dielectric properties
- 4.2 Prediction of molar polarization and effective dipole moment.
- 4.3 Effect of additives on electrical properties of polymers.
- 4.4 Optical properties
- 4.5 Effect of polymer structure on optical properties- clarity, transparency, haze, transmittance, reflectance, and gloss
- 4.6 Prediction of refractive indices of polymers by group contributions,
- 4.7 Static charges, volume & surface resistivity, arc resistance.

UNIT-5 CHEMICAL PROPERTIES

- 5.1 Cohesive energy, cohesive energy density, solubility parameter, determination of solubility parameter of polymers- Prediction of solubility parameter
- 5.2 Effect of polymer structure on solubility in solvents and oils
- 5.3 Influence of structure in prediction of flame retardancy, water repellency
- 5.4 Chemical resistance of polymers - Polymer toxicity.

References Books:

1. D.A.Seanor, ed., Electrical properties of polymers, Academic press, New York, 1982.
2. Jozef.Bicerano, Prediction of Polymer Properties, Second Edition, Marcel Dekker Inc. New York, 1995.
3. J.M.Margolis (Ed.), Engineering Thermoplastics Properties & Applications, Marcel Dekker, New York 1985.

