

PPE4I101 POLYMER STRUCTURE AND PROPERTY RELATIONSHIP

Module I:

Structure of polymers-Linear, branched, crosslinked, and network polymers-Homo chain and hetero atomic chain polymers-Copolymers-Linear and cyclic arrangement - Prediction of polymer properties, group contribution techniques, topological techniques- Volumetric properties-molar volume, density, Vander Waals volume- Coefficient of linear thermal expansion and volumetric thermal expansion-Pressure volume temperature (PVT) relationship.

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

Module II

Thermodynamic and transition properties-

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-Prediction of T_g and T_m of polymers by group contributions. Calorimetric properties-Heat capacity, specific heat, latent heat of crystallization and fusion, enthalpy and entropy- Calculation of heat capacities of polymers.

Module III

Electrical and optical properties-

Effect of polymer structure on dielectric constant, power factor, dissipation factor, and loss factor- effect of frequency of voltage and temperature on dielectric properties- Prediction of molar polarization and effective dipole moment. Effect of additives on electrical properties of polymers. Optical properties- Effect of polymer structure on optical properties- clarity, transparency, haze, transmittance, reflectance, and gloss- Prediction of refractive indices of polymers by group contributions

Module IV

Chemical Properties-

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

Reference

1. *D.W. Van Krevelen And P.J. Hoftyzen, "Properties Of Polymer , 3rd Edition Elsevier Scientific, Publishing Company Amsterdam - Oxford - Newyork . 1990.*
2. *J.E. Mark Ed.AIP, Physical Properties Of Polymers Hand Book, Williston, Vt, 1996.*

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Testing of Mechanical properties of polymers

1. *Compressive strength.*
2. *Flexural strength.*
3. *Izod and Charpy impact strength.*
4. *Falling dart impact strength,*
5. *Abrasion resistance,*

II. Testing of Thermal properties

1. *Vicat softening point.*
2. *Heat distortion temperature.*

III. Testing of electrical Properties.

1. *Comparative tracking index.*
2. *Dielectric strength.*

IV. Testing of Optical properties

1. *Refractive index.*
2. *Haze.*
3. *Gloss*

V. Testing of miscellaneous properties

1. *Environmental stress crack resistance*
2. *Chemical resistance.*
3. *Thermal ageing resistance.*
4. *Flammability.*