

POLYMER TESTING

Unit I

Standards and Specimen Preparation: Standards and specifications and their importance with reference to polymers. Preparation of test specimen by various techniques for thermoplastics, thermosets, and elastomers. Conditioning and test atmospheres.

Unit II

Mechanical properties: Tensile, compression, flexural, shear, tear, impact, abrasion, hardness, permanent set, resilience, flex and cut growth resistance. Basic concept of stress and strain; Short term (rubber elasticity, thermoplastics and thermosets) and Long term (Isochronous and isometric creep) tests; Viscoelastic behaviour [simple models: Kelvin model for creep and stress relaxation, strain recovery and dynamic response brief idea of other useful models. Effect of structure and composition on mechanical properties; Behaviour of filled and reinforced polymers.

Unit III

Thermal Rheological Properties: Transition temperatures, melt flow index, Vicat softening temperature, heat distortion temperature, coefficient of expansion, specific heat, thermal conductivity, shrinkage, brittleness temperature, thermal stability, and flammability. Plasticity, viscosity (plastimeter, Mooney viscometer, ODR, MPT, capillary rheometer, and torque rheometer)

Product Testing: Testing of Products - Plastic films, sheeting, pipes, laminates, foams, containers, and cables. Rubber hose, wire and cables, foams, gloves, tyres and tubes.

Unit IV

Electrical, Optical and other Properties: Volume and surface resistivity, dielectric constant and power factor, dielectric strength, arc resistance, tracking resistance. Dielectric behaviour of polymers [dielectric coefficient, dielectric polarization (mechanism), Dissipation factor and its importance etc.]; Refractive index, transparency, haze, gloss clarity, and birefringence. Environmental stress crack resistance (ESCR) - water absorption, weathering and chemical resistance, aging, ozone resistance, permeability, adhesion.

Text Books:

- 1 Vishu Shah, Handbook of Plastics Testing Technology, John Wiley, NY, 1998.
- 2 Roger P. Brown, Physical Testing of Rubber, interscience, New York, 1966.
- 3 Fundamental of Plastics Testing, S K Nayak, S N Yadav & S Mohanty , Springer

References:

1. Vishu Shah, Handbook of Plastics Testing Technology, John Wiley, NY, 1998.
2. ASTM: 8.01 & 8.04; 9.01 & 9.02, 2000
3. G. C. Ives & J. A. Mead, and N. M. Riley Handbook of Plastics Test Methods, ILIFEE, London, 1971
4. Roger P. Brown, Physical Testing of Rubber, interscience, New York, 1966.
5. Nicholas P. Cheremisinoff, Product Design and Testing of Polymeric Materials, Marcel Dekker, inc, New York, 1990