

Introduction to Engineering Polymers

Credits: 4

Unit-I: Introduction to polymers and plastics; Conception of polymers, formation of polymers, types of polymers reactions such as addition and condensation, Mechanism of polymerization - Thermoplastic and Thermosetting materials methods of polymerization.

Unit-II: Polymeric structure, raw materials and properties; Classification of polymers, raw materials for polymers and their sources. Brief study of structure of polymers and properties. Glass transition temperature and its significance. Crystallinity of polymeric materials, effect of time, temperature, catalysts and solvents on polymer properties, molecular weight of polymers.

Unit-III: Compounding and fabrication of plastics, calendaring and casting. Recycling of Plastics, Functions of the following types of additives used in Polymers. 1. Fillers 2. Lubricants 3. Reinforcing agents 4. Plasticizers 5. Stabilizers 6. Antioxidants 7. Inhibitors 8. Promoters 9. Catalysts 10. Refractors 11. Limiters 12. Colorants 13. Cross-linking 14. Blowing agents 15. Photo degradable 16. Bio-degradable, laminated polymers.

Unit-IV: Thermoplastics; Methods of addition polymerization, raw materials, manufacturing methods, properties and uses of the following ethenoid polymers; Polyethylene (LDPE and HDPE), Polypropylene, Poly Vinyl Chloride, Polystyrene, Expanded polystyrene, Polytetrafluoroethylene.

Unit-V: Thermosetting resins; Introduction of thermosetting polymers, methods of condensation polymerization, raw materials, manufacturing method, properties and uses of Phenol-Formaldehyde resin, Urea-formaldehyde resins, alkyl resins.

Unit-VI: Raw materials, manufacturing methods, properties and uses of the following plastics Acetals, Nylons, Polymethyl Methacrylate (PMMA), Saturated polyesters – PETP and PC, Cellulose acetate and viscose rayon. Introduction of natural rubbers and synthetic rubbers like Buna-S, Buna-N, Thiokol, Polyurethane rubber and Silicon rubber.

Resources:

Text Books:

1. Polymer science –Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar
2. Polymer science & technology – P. Ghosh

References:

1. Polymeric materials - science, properties, applications – Gottfried W. Ehrenstein
2. Polymer science & technology – Joel R. Fried
3. Materials science and engineering, an introduction – W. D. Callister, Jr., Adapted by R. Balasubramaniam