

Chapter 11

Polymers

Overview

Polymers can be classified in various ways, for example according to their macroscopic structure or their mechanical and thermal behavior. At the molecular level, polymer properties depend on chemical structure, molecular geometry, and the length of the polymer molecules. The main mechanisms for polymerization are addition and condensation. These typically give rise to a material with a fairly wide distribution in molecular size, or length. Many material properties show a systematic dependence on the average molecular weight. The properties of a number of important thermoplastic polymers will be presented, and their main characteristics and common applications will be discussed.

After studying this chapter, you will be able to :

1. Classify polymer materials, depending on physical properties and molecular characteristics;
2. Explain the two main polymerization mechanisms leading to the formation of long-chain polymer molecules;
3. Outline important geometrical structural effects such as isomers, variable chain structure, and copolymers;
4. Analyze a polymer molecular weight distribution by determining its number and weight average molecular weights;
5. Describe the main effects of molecular weight on polymer properties;
6. Name some of the most important industrial polymeric materials, and delineate their properties and uses on the basis of their molecular structure.