Introduction

Basic concepts of polymer chemistry

polymer, mer, thermoplastic, thermosetting, elastomer, fiber, classification of polymers according to chain structures, polymerization methods.

Changing one or more of the following parameters can affect the linearity of the polymer, its average molecular weight, the tacticity of side chains on the polymer backbone, and the density of the product.

The following variables can be controlled when producing a polymer.

- The monomer polymerized or the monomers copolymerized.
- The reagent used to initiate the polymerization reaction.
- The identity and amount of the reagent used to crosslink the polymer chains.
- The temperature and pressure at which the polymerization occurs.
- The solvent in which the monomer is polymerized.
- The way the polymer is collected, which can produce either a more or less random alignment of the polymer chains or a fabric in which the chains are aligned in one direction.

Since polymers have high molecular mass**,** they can be described in many ways: polymerization degree, molecular weight distribution, the branching degree, crosslinks, cystallinity, glass transition temperature and melting temperature.

Factors determined the properties of a polymer

Reaction conditions : Temperature, pressure and catalysts affect the length and branching of the polymer chain.

Monomer : The type of monomer used affects the type of forces between polymer chains.

Additives : Additives can incorporated for various goals above mentioned.

Polymers are macromolecules which consists of large numbers repeated structural units known as monomers.

Monomers are small molecules that combine with each other to form polymer molecules. The simple reactive molecule from which the repeating structural units of a polymer are derived is called a monomer.

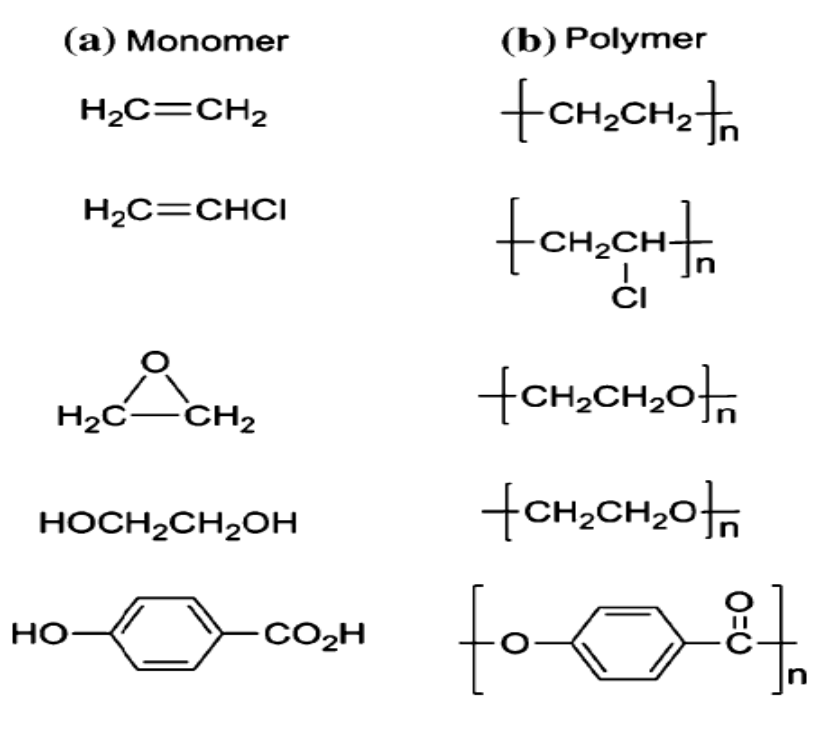
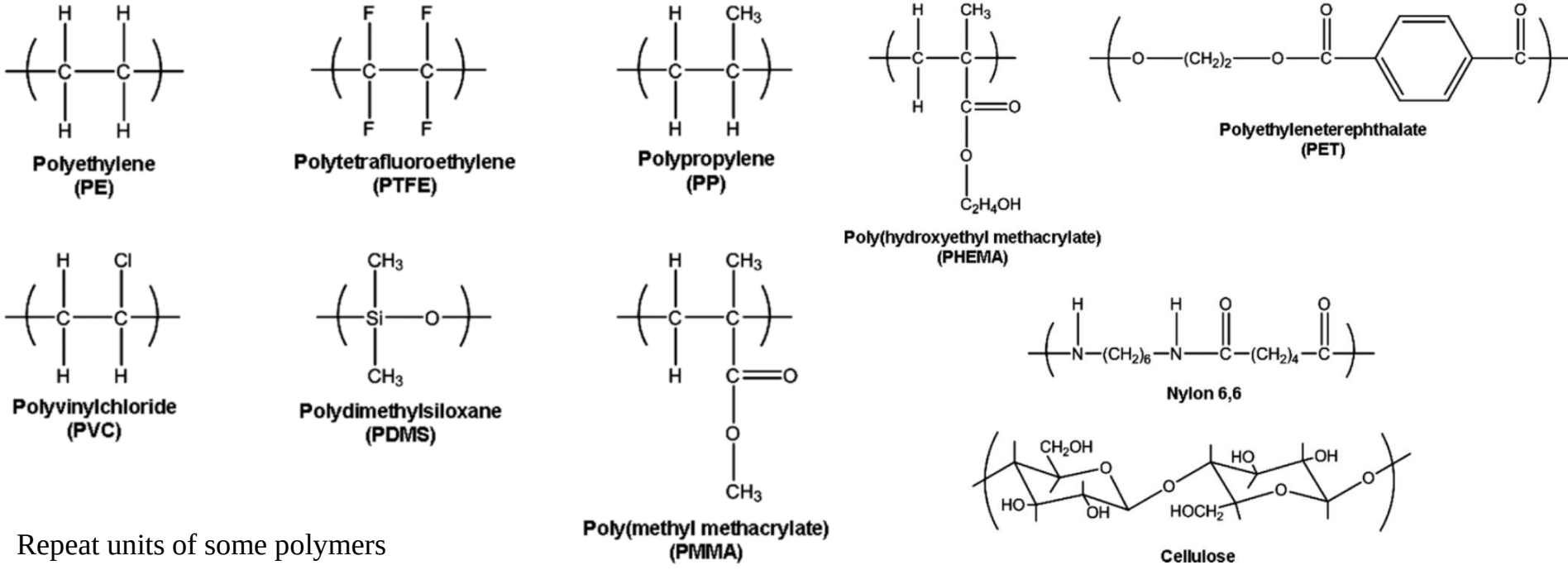


Fig. 1.1 Chemical structures of (**a**) monomers and (**b**) their corresponding polymers

Repeating units

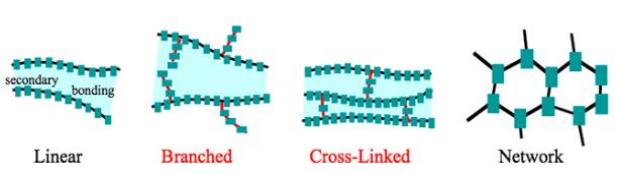
The difference between the monomer and the repeat unit is the loss of the double bond in the former to give the chain-linked repeating group. Thus the molecular masses of both monomer and unit are identical.

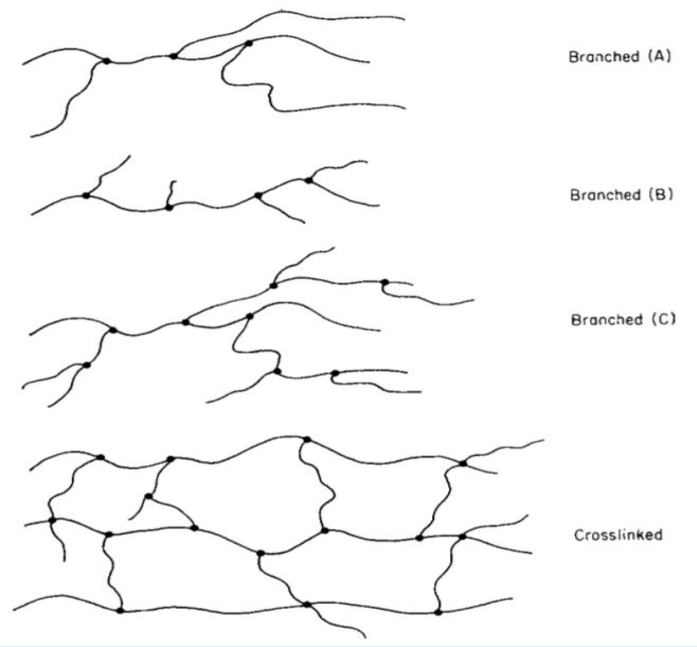


Repeat units of some polymers

Classification of polymers

Polymers can be classified as linear, branched, or crosslinked polymers depending on their structure.





In addition polymers are divided into two categories as homopolymer and copolymers to the number of type of repeating units.

The other important classification of polymers;

Thermoplastics are the plastics that, when heated, do not undergo chemical change in their composition and so can be molded again and again.

Thermosets, or **thermosetting polymers**, can not melt and take shape only once: after they have solidified, they stay solid.

	Plastic	Comments
PMMA	acrylic, poly(methyl methacrylate)	Thermoplastic. A transparent rigid polymer.
ABS	acrylonitrile-butadiene-styrene	Based on SAN resin modified with polybutadiene rubber.
EP	epoxy	Thermoset. Resins used for encapsulation, adhesives, surface coatings and high-strength fibre-reinforced composites.
HDPE	high density polyethylene	Thermoplastic. Linear polyolefin widely used in blow moulding.
MF	melamine formaldehyde	Thermoset. Used in domestic ware, switches, plugs, etc.

Elastomers

The term of elastomer, is often used interchangeably with rubber. They are amorphous polymers having glass transition temperature. Also they have less croslinking bonds, between polymer chains which permit the polymers to stretch in response to macroscopic stresses. Rubber-like solids with elastic properties are called elastomers.

Elastomers, generally, have low Young's Modulus and high failure strain compared with other materials.