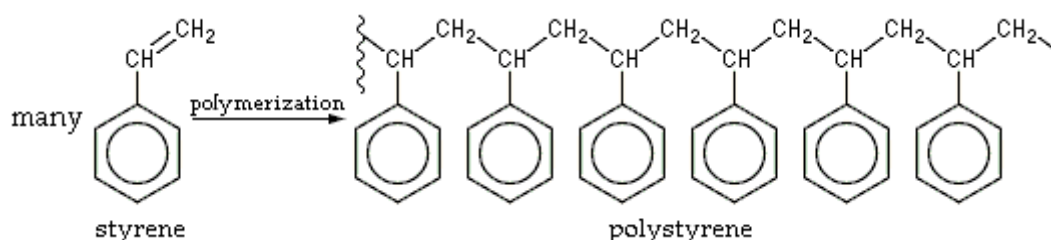


M.Sc. Sem I, CC-2, Physical Chemistry

What is Polymerization?

Polymerization is a process through which a large number of monomer molecules react together to form a polymer. The macromolecules produced from a polymerization may have a linear or a branched structure. They can also assume the shape of a complex, three-dimensional network. There exist several categories of polymerization reactions; the most important ones are step-growth polymerization, chain-growth polymerization (both fall under the category of addition polymerization), and condensation polymerization.

A polymer is a substance that is made up of very large molecules that are, in turn, made up of many repeating units called monomers. Polymerization is the process through which these monomers come together to form the macromolecules that constitute polymers. An illustration detailing the polymerization of the monomer styrene into the polymer known as polystyrene is provided below.



Depending on the functional groups present in the reacting monomers, the complexity of the mechanism of the polymerization reaction may vary. The simplest polymerization reactions involve the formation of polymers from alkenes via free-radical reaction. Polyethylene, which is one of the most commercially important polymers, is prepared through such a polymerization process (the reactant monomer used here is ethylene).

It should be noted that polymerizations involving only one type of monomer are called photopolymerization, whereas those involving more than one type of monomer are called copolymerization processes. In simple words, we can describe polymerization as a chemical process that results in the formation of polymers or the process of creating polymers. When polymerization occurs, the smaller molecules, which are known as monomers via chemical reaction, are combined to form larger molecules. A collection of these large molecules forms a polymer. The term polymer, in general, means “large molecules” with higher molecular mass. They are also referred to as macromolecules.

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Polymers are formed by the addition of a network of structural units or monomers, as mentioned above. The interesting part is that these are reactive molecules and are usually linked to each other by covalent bonds. These monomers add together to form a long chain to form a product with specific properties. This whole process of the formation of polymers is called polymerization. Polythene and Nylon 66 are some examples of polymers.

Mechanism of Polymerization

Generally, polymerization consists of three steps which include initiation, propagation, and termination. As for the reaction mechanism, the process of polymerization mainly involves two different methods, the step-growth mechanism and the chain-growth mechanism.