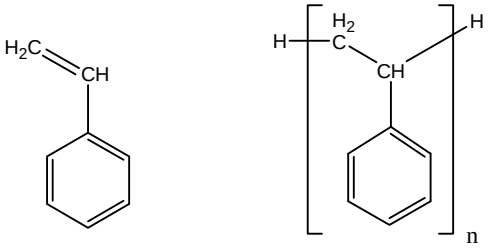
It is an understatement to say that polymers are of significant industrial importance. The range of applications for polymers grows each year including uses in biology, medicine, aerospace, engineering and seemingly limitless other commercial applications. It is our intention in this short article to provide a scientific definition for a polymer.

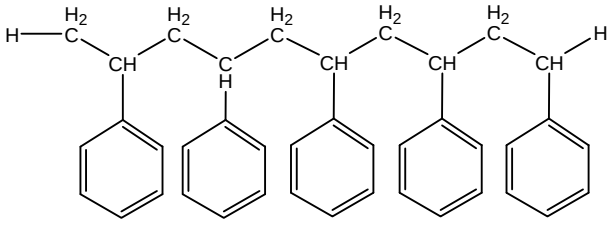
A polymer is a large molecule which is formed using a repeating subunit. The subunit from which a polymer is built is called the monomer. Figure 1 shows an example of a polymer and the monomer from which it is made. The monomer in this example is styrene and the polymer that is formed is poly(styrene). It is customary when naming a polymer to label it by placing the prefix poly in front of the name of the monomer.

Polymers are formed when multiple monomer units react together to form a long chain. It is the length of the chain which determines many of the properties of the final material. Polymer chemists describe the length of the chain using the term degree of polymerization (DP). The DP of a polymer is equal to the number of monomer repeat units in the structure. Figure I shows an example where the DP of polystyrene is 5.

Polymers can form long linear chains as in the case of the polystyrene shown in Figure I. In addition, it is also possible to prepare polymers with different geometries (branching structures) by introducing branch points on the polymer chain. Figure II shows examples of the types of geometries which have been prepared for various systems. The characteristics of polymers of the same chemistry and molecular weight but with different branching structure can vary substantially in their physical properties. (Odian, 1991), (G.P. Belova, 1978)



Styrene Monomer Polystyrene Polymer of n Repeat Units



Polystyrene Oligomer with Degree of Polymerization Five

Figure I: Example of polymer structure showing styrene monomer (top left), polystyrene (top right) and a styrene oligomer, degree of polymerization five (bottom).

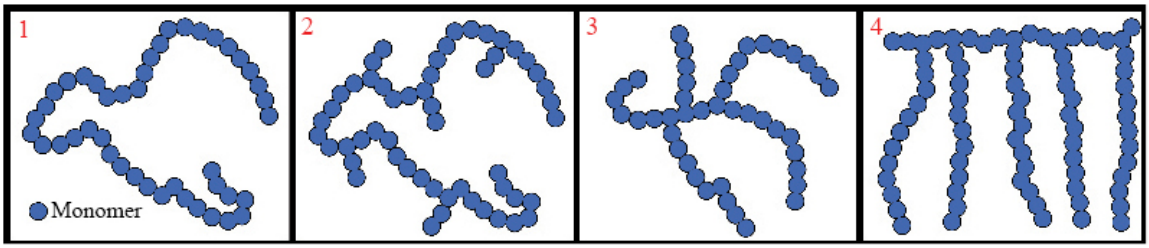


Figure II: Examples of different polymer geometries including linear (1), short chain branching (2), long chain branching (3) and comb shaped polymers (4).

Works Cited

1. G.P. Belova, N. V. (1978). Effect of branching on the structure and mechanical properties of polyethylene. Polymer Science U.S.S.R. , 20, 3021-3028.
2. Odian, G. (1991). Principles of Polymerization. New York: John Wiley & Sons Inc.