When addition polymers are formed, no by-products result. Formation of a condensation polymer, on the other hand, produces H₂O, HCl, or some other simple molecule which escapes as a gas. A familiar example of a condensation polymer is nylon, which is obtained from the reaction of two monomers

\[
\text{Hexamethylenediamine} \quad \text{Adipic acid}
\]

\[
(n + 1) \text{H}_2 \text{N} - (\text{CH}_2)_6 \text{NH}_2 + (n + 1) \text{HOOC} - (\text{CH}_2)_4 \text{COOH} \rightarrow
\]

A solution of adipoyl chloride in cyclohexane is poured on top of an aqueous solution of 1,6-diaminohexane in a beaker. Nylon (6,6) polyamide is formed at the interface of the two immiscible liquids and is carefully drawn from the solution and placed on a glass rod. The rod is then spun, and the Nylon (6,6) polyamide is spun onto the rod.

Well-known condensation polymers other than nylon are Dacron, Bakelite, melamine, and Mylar. Nylon makes extremely strong threads and fibers because its long-chain molecules have stronger intermolecular forces than the London forces of polyethylene. Each N—H group in a nylon chain can hydrogen bond to the O of a C=O group in a neighboring chain, as shown below. Therefore the chains cannot slide past one another easily.

Figure \(\PageIndex{1}\): The three nylon molecules are held together by hydrogen bonding. The N-H group of one chain hydrogen bonds to the C=O group of another chain. This makes nylon quite strong and difficult to pull apart.

If you pull on both ends of a nylon thread, for example, it will only stretch slightly. After that it will strongly resist breaking because a large number of hydrogen bonds are holding overlapping chains together. The same is not true of a polyethylene thread in which only London forces attract overlapping chains together, and this is one reason that polyethylene is not used to make thread.

**Contributors**

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