Polypropylene Encyclopedia Article

Polypropylene

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Polypropylene

Polypropylene is a polymeric material produced by the polymerization of propene. It is a solid material that typically has a molecular weight of over forty thousand. It is a thermoplastic polymer and is softened by solvents as well as by heat, chlorine, fuming nitric acid, and strong oxidizing agents. Ultraviolet light can degrade it. The polymer is easily dyed and resists fungi and mold.

Although Giulio Natta was the man who actually developed polypropylene, he drew largely upon the breakthroughs of Karl Ziegler. Ziegler and his collaborators discovered that organometallic compounds (carbon compounds containing a transition metal) were catalysts for polymer reaction. In 1952 Ziegler succeeded in preparing a high molecular weight polyethylene at room temperature.

Natta, working for the Italian company Montecatini, set out to develop a high molecular weight polypropylene, choosing propylene because it was much cheaper and more readily available than ethylene. Natta sent workers to Ziegler's research lab to learn how to work with catalysts. By 1954 he and his research group created a polypropylene with high durability, heat resistance, and tensile strength. It also had another property that they had not anticipated.

All of the methyl groups along the carbon chain of the polypropylene were on the same side. This kind of polymer is now called an *isotatic*polymer. Natta and his group continued their research until they were able to use catalysts to place the pendant groups of the carbon chains where they wanted them. This catalyzed polypropylene turned out to be the first of many stereoregular or syndiotactic polymers (polymers whose pendant groups attach themselves to alternate sides of the molecule).

Polypropylene is used in films, automotive parts, appliances, housewares, carpet fibers, crates, labware, fish nets and surgical supplies. Its discovery led to a change in the perception of polymers. Until that time, there had been substances whose structures could not be predicted; the discovery that stereoregularity could be controlled, however, ushered in a new era of "designer" polymers.