Polyurethane Encyclopedia Article

Polyurethane

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Polyurethane

Polyurethane is an elastic polymer formed by a condensation reaction between diisocyanates and dihydroxy compounds, usually alcohols. This results in a molucule consisting of a rigid urethane group alternating with a soft chemical group. These alternating soft and hard segments are responsible for the elastic properties of the urethanes. Urethane elastomers--substances resembling rubber--are made by using an ether or ester type constituent in one of the prepolymers. Urethane elastomers resist ozone but are easily degraded by acids, alkalies, and steam.

Polyurethane might never have been discovered if not for the scarcity of rubber during World War II and the success of Du Pont's nylon. During the 1940's, Du Pont started a project to develop alternatives to rubber. In 1947, Adolf von Baeyer published a paper detailing the research he and his team had accumulated on diisocyanates and dihydroxy compounds used to form polyurethanes and polyureas from diisocyanates and diaminos. Von Baeyer stated that the original purpose of the research was to develop a substitute for nylon without violating any of Du Pont's patents. When scientists found that these polyurethanes could be made into fine threads the usefulness of these materials were soon realized.

Polyurethanes are used to produce spandex clothing which are lightweight and form-fitting. They are also used in solvent-resistant coatings, abrasive resistant rubbers, fibers and foams. The latter currently represents the biggest market for polyurethanes; the foams vary from very flexible to extremely rigid and are used in furniture, carpet backing, and insulation. The rigidity of the foam is determined by the degree of crosslinking that occurs. Lower molecular weight reactants tend to produce more rigid foams.