Ultrasoft Thermoplastic Polyurethanes

This work evolved from collaboration between my laboratory and CPT Industries, Inc. I have a graduate student conducting his Ph.D. research at CPT and performing thermal analysis in my laboratory (45). We have developed formulas for soft (Shore A hardness below 80) thermoplastic poly(carbonate urethane)s that do not exhibit surface tackiness. These novel polyurethanes target growing markets for biocompatible polymers used in peristaltic pump tubing, balloon catheters, enteral feeding tubes and medical equipment gaskets and seals. One of the barriers to wider use of poly(carbonate urethane)s has been the commercial unavailability of soft grades (below 75 Shore A). In this study we use conventional, methylene bis (4-cyclohexylisocyanate) and 1,4 butanediol chain extender with a novel polycarbonate polyol containing, 3-methyl-1,5-pentanediol. This diol is the key to the unusual properties. A typical polycarbonate polyol is a crystalline solid at room temperature. Such polycarbonates yield polyurethane elastomers that are tough, but also stiff; this is caused by the tendency of the soft segment to crystallize. By using the modified, low crystallinity polycarbonate copolymer diol depicted in Fig. 11 we have been able to demonstrate the ability to maintain excellent physical and mechanical properties in hardness ranges between 60 and 70 Shore A.

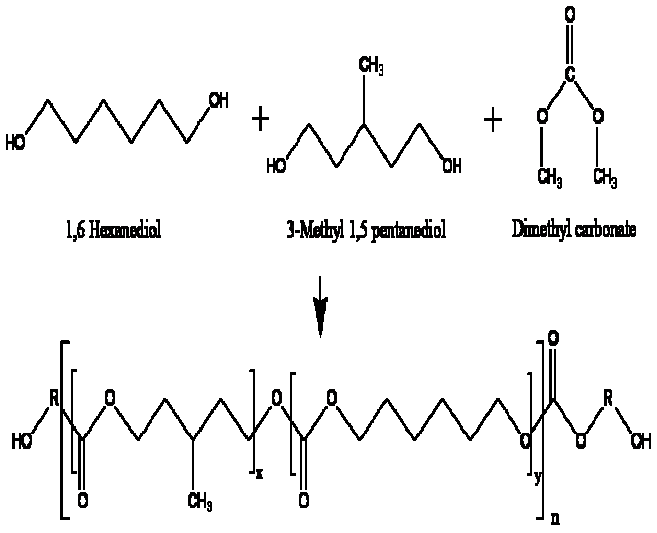

Figure 11

These exciting results have prompted us to undertake a fundamental study on the relaxation behavior of a series of these polymers in order to understand the pronounced effect of the 3-methyl group on polymer properties.

References

45. "A New Generation of Ultra-soft, Non-blocking Polyurethanes with Superior Mechanical Properties for Biomedical Applications", K. Kull, T. Gerasimov and J. P. Harmon, submitted to TOPCON 2005 Bounce Back with TPE's Proceedings, Akron Ohio, (2005).