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Rubber Toughening of an Amorphous Polyamide

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There is an extensive body of literature on the rubber toughening of semi-crystalline polyamides like PA-6 and PA-66 based on coupling of the phases through the amine-anhydride reaction. The bulk of this literature interprets the toughening response in terms of mechanisms that deal with the matrix as a continuum ignoring any contribution from its semi-crystalline character; however, recent papers by Argon et al suggest alternative explanations in terms of contributions from the polyamide crystalline phase and how it is affected by the rubber particles. To better understand the relative merits of the two points of view, it would be useful to compare and contrast any differences in toughening behavior with those of amorphous polyamides. Thus, toughening of an amorphous polyamide (Zytel 330 from DuPont) by blending with various types of elastomers (SEBS triblock and ethylene random copolymers with propylene and octene) are being studied in some detail within our laboratories. Blends were prepared in both single and twin-screw extruders with the latter generally giving best results. Rubber particle size was varied over a wide range using combinations of maleated and unmaleated versions of the elastomers; morphology has been quantitatively characterized by image analysis of transmission electron micrographs. Room temperature fracture energies and ductile-to-brittle transition temperatures have been determined and related to the morphology of the various blends and to the characteristics of the elastomers. This presentation will give a progress report on this work with a view of obtaining a better understanding of the operative mechanisms through examination of the details of the structure-property relationships for amorphous versus semi-crystalline polyamide matrices.