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Effect of Segment Length on the Tensile Properties of Segmented Block Copolyetheresters Based on Poly(butylene terephthalate) and Poly(tetramethylene ether glycol)

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Segmented block copolyetheresters defined as copolymers having sequences of alternating polyester hard blocks and polyether soft blocks create labile physical cross-links upon crystallization of hard polyester blocks. The physical and mechanical properties of these block copolymers are largely affected by their phase structure which depends on the hard segment content and the segment length. In this study the effect of hard and soft segment length on the tensile properties of segmented block copolyetheresters based on poly(butylene terephthalate) and poly(tetramethylene ether glycol) was examined. The number average molecular weight of poly(tetramethylene ether glycol) used were 650, 1000, and 2000. The 15 samples, 5 different hard segment contents for every 3 kinds of soft segment types, were synthesized. The tensile properties such as tensile strength, breaking elongation, initial modulus, toughness, etc. were examined for the copolymer films in order to investigate how did the hard segment content and the segment length affect these tensile properties.

For the melt pressed samples, tensile strength increased with hard segment content, while the breaking elongation showed maxima when hard segment content is 50 and 65wt% for PTMG 1000 and 650 system, respectively. For samples with 80wt% of hard segment contents, PTMG 2000 system showed no yielding and no plastic deformation, while both PTMG 1000 and 650 system showed characteristic yield behavior. It is thought to be due to the long hard segment length of PTMG 2000 samples which has about 39 units of butylene terephthalate as a hard segment block and hence it acts like PBT film on elongation. Effect of annealing and drawing on these properties were also examined.