SYNTHESIS AND CHARACTERIZATION OF ETHYLENE-PROPYLENE BLOCK COPOLYMERS

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ABA type ethylene-propylene block copolymers were synthesized with a dry $TiCl_3$(AA)-Et_2AlCl initiator system by sequential monomer addition using a gas-phase polymerization technique. By manipulating the lengths of each block and the composition of the random copolymer B block, different block copolymer structures in monomer composition and sequence distributions were prepared.

Various analytical techniques were used to investigate the relationships between the molecular structure and property of block copolymers; (1) Infra-red spectroscopy for determination of copolymer composition, (2) Differential Scanning Calorimetry for thermal behavior, (3) ^{13}C Nuclear Magnetic Resonance spectroscopy for the monomer and sequence distributions, (4) Instron tensile tester for stress-strain behavior, and (5) Autovibron for dynamic mechanical analysis.

The block architecture as well as monomer composition would be expected extremely important in determining the physical and mechanical properties. The important structural parameters, such as the length of polypropylene end blocks, length of random block and propylene:ethylene monomer feed ratios in the random block, were examined on the properties of ABA type ethylene-propylene block copolymers.

The stress-strain measurements show that there is an optimum ratio of each block length for the best combination of strength, elongation, elastic recovery and modulus. Especially, the elastic recovery from elongation can be improved by manipulating the each block length and the composition of the random copolymer block. This indicates that the performance of ABA type ethylene-propylene block copolymers is comparable to commercially available thermoplastic elastomers, thus making feasible to produce thermoplastic elastomeric fibers.

Ethylene-propylene random copolymers were prepared by admitting both monomers simultaneously, in various ratios, in order to correlate their behavior to the nature of the random copolymer block for ABA type block copolymers. The relationships between the composition and physical-mechanical properties were investigated using the various techniques previously mentioned. The results from these analyses convincingly demonstrated that the 'blockiness' was developed by the nature of a $TiCl_3$-based initiator and the ratio of monomers in the feed.