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Controlled Chain Walking for the Synthesis of Thermoplastic Polyolefin Elastomers: Synthesis, Structure, and Properties

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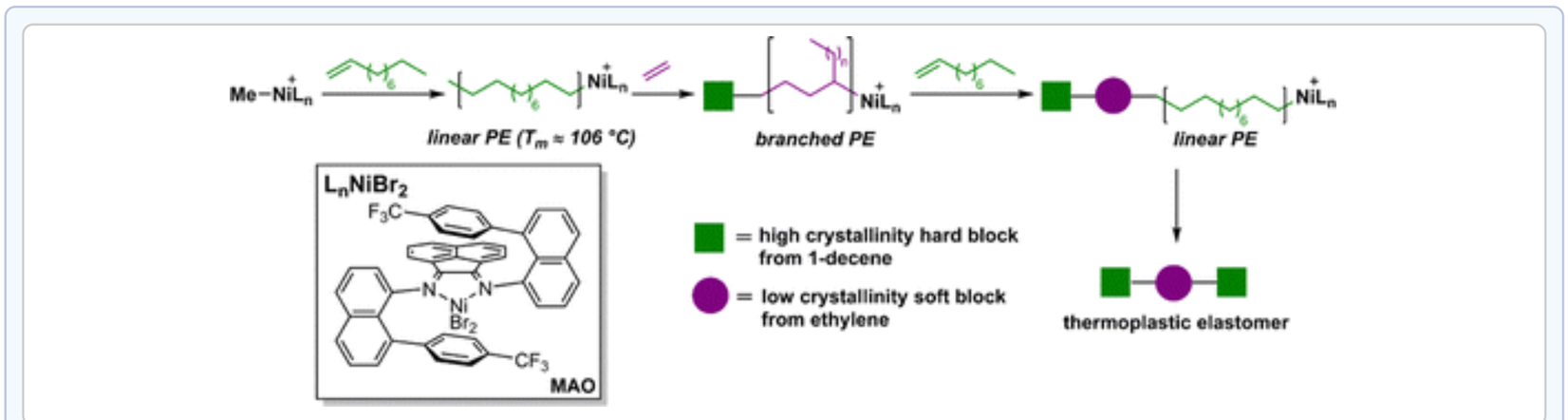
Abstract



Thermoplastic elastomers are attractive materials because of their ability to be melt-processed, reused, and recycled, unlike chemically cross-linked elastomers such as rubber. We report the synthesis and mechanical properties of polyolefin-based thermoplastic elastomer block copolymers. A simple one-pot procedure is employed, using a living arylnaphthyl-α-diimine Ni(II) "sandwich" complex to generate high crystallinity hard blocks from 1-decene and low crystallinity soft blocks from ethylene. Various block structures are accessed, ranging from a diblock up to a heptablock copolymer. Statistical copolymers of 1-decene and ethylene are also synthesized for comparison. All resulting polymers behave as elastomers, with properties that modulate with hard and soft block composition, block architecture, and polymerization solvent. Triblock copolymers demonstrate strain at break values up to 750%, with elastic strain recoveries up to 85%. Interestingly, statistical copolymers demonstrate strain at break values upward of 1120% and elastic strain recoveries up to 77%. Creep experiments were performed to determine the resilience of these materials to deformation. It is found that higher block architectures (triblock and above) have greater resistance to strain-induced deformation than lower block architectures (diblock and statistical).

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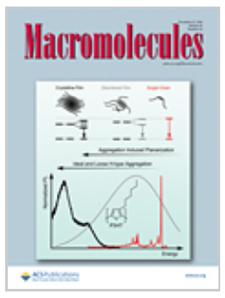

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Macromolecules **2016** *49* (24), 9521-9530
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