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Properties of Well-Defined Elastomeric Poly(alkylnorbornene)s and Their Hydrogenated Derivatives RICHARD REGISTER, JOHN HATJOPOULOS, JOHN BISHOP, Princeton University — Narrow-distribution homopolymers of various 5-n-alkylnorbornenes were synthesized by living ring-opening metathesis polymerization (ROMP), and subsequently hydrogenated to yield materials with the good thermooxidative stability of polyolefins. The unsubstituted hydrogenated polynorbornene is highly crystalline, with Tm = 140-150C, but all the substituted norbornenes (before and after hydrogenation) are amorphous. Hydrogenation reduces the glass transition temperature (Tg) modestly; polymers with butyl or longer substituents have Tg below ambient due to internal plasticization by the alkyl sidechains (Tg = -40C for hydrogenated polydecylnorbornene). The fractional decrease in Tg with increasing sidechain length is in good quantitative agreement with that for polyolefins, polymethacrylates, and poly(alkylstyrene)s, when the sidechain length is normalized by the number of backbone carbons per mer. The rubbery plateau moduli for these hydrogenated products are typical for elastomers, and tunable through the length of the alkyl sidechain; lengthening the sidechain from butyl to decyl increases the entanglement molecular weight by nearly a factor of three. These materials show promise as the midblocks in ROMP thermoplastic elastomers with crystalline endblocks. [work supported by NSF Polymers Program, DMR-0505940]

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