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Synthesis and rheological behavior of atactic polypropylene molecular bottlebrushes[1] SAMUEL DALSIN, FRANK BATES, MARC HILLMYER, Univ of Minn - Minneapolis — Molecular bottlebrushes are branched polymer structures characterized by an extremely high density of polymeric side chains emanating from a central backbone. Due to unique conformational and rheological properties, molecular bottlebrushes have become attractive candidates for developing new photonic bandgap materials, nanotubes and nanowires, and rheological modifiers. In this study, bottlebrushes comprised of atactic polypropylene (aPP) side chains were synthesized via ring-opening metathesis polymerization of norbornenyl-terminated aPP macromonomers. A series of bottlebrush polymers with fixed side chain length and variable backbone length was prepared using Grubbs' third-generation catalyst, yielding products with low dispersity in less than five minutes reaction time. Small-amplitude oscillatory shear measurements were performed to examine linear viscoelastic properties. Master curves of all bottlebrush polymers exhibited relaxation spectra devoid of any entanglement plateau, despite high molecular weights (up to 892 kg/mol). Lack of entanglement was further confirmed by zero shear viscosity experiments, which displayed a nearly linear dependence on molecular weight. These rheological properties are compared directly with a linear aPP control sample.

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