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Hydrogen Bonding in Poly(butyl acrylate) Melts and Elastomers[1]

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— Hydrogen bond strength and density are critical design variables that influence the formation of supramolecular networks from linear polymers. Larger, higher strength H-bonding groups, tend to be more susceptible to aggregation, phase segregation and stacking. However, even weak, monovalent and bivalent hydrogen bonding groups can increase melt viscosity, compatiblize binary blends, and introduce hierarchal structure into amorphous melts. We prepared a series of poly(butyl acrylate) copolymers with different amounts and types of hydrogen bonding sidegroups (HBG's). Copolymers containing "weak" HBG's behaved as unentangled melts, with no indication of network formation. Copolymers bearing strong hydrogen bonding groups (UPy) behaved as soft, elastic solids. The rheologically distinct behavior of UPy-containing copolymers is attributed to dimer lifetimes exceeding the experimental timescale. Results are relevant to developing adaptable materials including shape memory polymers, self-healing materials, damping materials and adhesives that utilize hydrogen bonding to influence bulk mechanical properties.

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