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Controlling Miscibility in Polyethylene-Polynorbornene Block Copolymers via Side-Group Chemistry. WILLIAM MULHEARN, RICHARD REGISTER, Princeton University — Block copolymers containing a crystallizable block, such as polyethylene (PE), and an amorphous block with high glass transition temperature (T_g) are an interesting class of materials since the rigid glassy block can improve the mechanical response of the article under strain by reinforcing the crystal fold surface. However, to prepare an easily processable PE-containing block copolymer it is necessary to avoid microphase separation in the melt by selection of amorphous blocks with weak repulsive interactions against PE (low Flory interaction parameter χ or interaction energy density X). Most such low- χ polymers are chemically similar to PE, such as copolymers of ethylene and a small amount of an α -olefin, and therefore exhibit similarly low glass transition temperatures. This work investigates a series of low- and high- T_g polymers based on substituted norbornene monomers, polymerized via ring-opening metathesis polymerization (ROMP). Hydrogenated polynorbornene derivatives possess a wide range of glass transition temperatures, and miscibility with PE can be readily tuned by the choice of substituents on the monomers (e.g. aromatic vs. aliphatic groups). Two species investigated, hydrogenated poly(cyclohexyl norbornene) and hydrogenated poly(norbornyl norbornene), have high T_g and also remain miscible with polyethylene to high molecular weight. Furthermore, we develop a set of mixing rules to qualitatively predict the solubility behavior of substituted ROMP polynorbornenes as a function of their side-groups.

William Mulhearn
Princeton University

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