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Tailoring Phase Behavior and Mechanical Properties in Thermoplastic Elastomers through Block Sequence and Macromolecular Architecture ADAM BURNS, RICHARD REGISTER, Princeton University — Block copolymers exhibit unique properties which depend not only on the identities of the constituent blocks but also the block sequence and macromolecular architecture. Thermoplastic elastomers (TPEs) are a prime example. In TPEs the arrangement of glassy end blocks flanking a long rubbery midblock gives rise to a physically crosslinked, elastic solid. Exchanging the glassy blocks for crystalline blocks can improve the processability and solvent resistance, but adversely affects the mechanical performance. The block sequence crystalline-glassy-rubbery-glassy-crystalline has been developed to combine the advantages of both crystalline and glassy blocks. Careful selection of block lengths produces materials in which the order-disorder transition temperature lies below the melting point of the crystalline block, ensuring that the melt will be homogeneous above the melting point. Access to single-phase melts provides a large reduction in viscosity and elasticity over conventional TPEs, which remain microphase-separated in the melt. Inserting the glassy blocks between the crystalline and rubbery blocks produces a vitreous layer surrounding the crystalline domains, which improves the room-temperature mechanical performance. Incorporating the crystalline-glassy-rubbery motif into the arms of star block copolymers adds another level of control. The star architecture introduces a permanent crosslink at the center of the star without appreciably affecting the phase behavior.

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