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Effect of chain bridging on mechanical properties of lamellae-forming block copolymers ALHAD PHATAK, LISA LIM, CLETIS REAVES, FRANK BATES, Department of Chemical Engineering and Materials Science, University of Minnesota — We report studies on solid-state mechanical properties of lamellae-forming block copolymers composed of poly(cyclohexylethylene) (C) and poly(ethylene) (E). Specifically, we have investigated the effect of bridging conformations in the semicrystalline E block. We studied CEC, ECEC, and ECECE architectures and found that tensile properties of C/E block copolymers are extremely sensitive to the fraction of "soft" E chains tethered between glassy C domains. While the CEC polymer has a strain-to-failure of ∼300%, the ECEC and ECECE polymers fail at ∼1% strain. By employing ECEC/CEC and ECECE/CEC blends, we have come up with a molecular parameter that describes a sharp brittle-to-ductile transition and captures the tensile properties of a broad range of C/E block copolymer architectures having equal sized E blocks. In another set of experiments, increasing the "middle-to-loose" E block length ratio was found to toughen the ECECE block copolymers. We propose that these effects are related to a critical concentration of bridged E chains that governs the failure mechanisms in glassy-semicrystalline block copolymers.

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