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Order and Disorder in Polydisperse Block Copolymer Melts
NATHANIEL LYND, MARC HILLMYER, University of Minnesota — Utilizing creative strategies for the synthesis of model controlled-polydispersity poly(ethylene-*alt*-propylene)-*b*-poly(D,L-lactide)(PEP-PLA) and polystyrene-*b*-polyisoprene(PS-PI) block copolymers, the effects of increased breadth in the molecular weight distribution on block copolymer self-assembly were investigated. Small-angle x-ray scattering and rheological measurements were carried out to characterize the morphological details of these self-assembled materials as a function of their polydispersity, interaction strengths, and compositions. A number of surprising consequences of increased breadth in the molecular weight distribution emerged; the domain spacing of the ordered structures increased, changes in morphology occurred, and the degree of segregation at the order-disorder transitions changed as well, particularly for asymmetric block copolymers. The change in the degree of segregation at the order-disorder transition as the polydispersity was increased was found to be dependent on the block copolymer composition, e.g., for PEP-PLA and PS-PI at asymmetric compositions, when the polydispersity was increased in the minority component, the degree of segregation at the order-disorder transition decreased, whereas when the polydispersity was increased in the majority component, the degree of segregation at the order-disorder transition increased.

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