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Dynamics of entangled rod-coil block copolymers MUZHOU WANG, KSENIA TIMACHOVA, ALFREDO ALEXANDER-KATZ, Massachusetts Institute of Technology, ALEXEI E. LIKHTMAN, University of Reading, BRADLEY D. OLSEN, Massachusetts Institute of Technology — Polymer science is exploring advanced materials which combine functional domains such as proteins and semiconducting polymers with traditional flexible polymers onto the same molecule. While many studies have focused on equilibrium structure-property relationships, little is known about how the conformational restrictions of rigid domains affect dynamical phenomena such as mechanical properties, processing pathways, and self-assembly kinetics. We have recently introduced a reptation theory for entangled rod-coil block copolymers as a model for this wider class of functional polymeric materials. The theory hypothesizes that the motion of rod-coils is slowed relative to rod and coil homopolymers because of a mismatch between the curvature of the rod and coil entanglement tubes. This effect leads to activated reptation and arm retraction as two relaxation mechanisms that govern the short and long rod regimes, respectively. These results were verified by tracer diffusion measurements using molecular dynamics simulation and forced Rayleigh scattering in both the rod-coil diblock and coil-rod-coil triblock configurations. The tracer diffusion results were then compared to experimental self-diffusion measurements which require a consideration of the motion of the surrounding chains.

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