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Effect of linear contaminants on the dynamics and rheology of ring polymer melts JONATHAN HALVERSON, Max Planck Institute for Polymer Research, GARY GREST, Sandia National Laboratories, KURT KREMER, Max Planck Institute for Polymer Research — Understanding the behavior of ring polymer melts remains a challenge. Early experimental efforts to characterize the rheological behavior of pure ring polymer melts have led to controversial results most likely because the samples were contaminated with linear chains. Recent studies found that stress relaxation follows a simple power law with no sign of a plateau. To further investigate these systems we have conducted molecular dynamics simulations for a semiflexible bead-spring model for chain lengths up to 14 entanglement lengths. The structure, dynamics and rheology of these systems are investigated for different concentrations of linear chains. We find that the viscosity of a ring melt increases dramatically when trace quantities of linear contaminants are present. The rings are found to swell slightly and diffuse more slowly with increasing linear concentration while the linear chains mostly behave as if in a pure linear melt. We use the concept of threading, analogous to thread passing through the eye of a needle, to explain the response of the ring melts to linear contaminants.

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