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Single polymer dynamics of linear and architecturally complex chains in semi-dilute solutions KAIWEN HSIAO, Univeristy of Illinois at Urbana Champaign, YANFEI LI, GREGORY MCKENNA, Texas Tech University, CHARLES SCHROEDER, Univeristy of Illinois at Urbana Champaign — The interplay between polymer topology and concentration gives rise to complex dynamics due to inter- and intramolecular interactions. We use a molecular level approach to study the threading behavior for linear and ring polymers near equilibrium and in non-linear flows. A semi-dilute solution of linear DNA chains is doped with fluorescently labeled ring polymers (circular DNA plasmids), and this material is used to study the dynamics of rings in semi-dilute solutions of linear chains. Single molecule fluorescence microscopy in combination with a custom-built microfluidic trapping system is used to study collective polymer dynamics at the molecular level, which allows us to precisely control flow rates and accumulated fluid strain applied to single polymer. We performed step-strain experiments on ring polymer in linear semi-dilute polymer solutions undergoing deformation in planar extensional flow. In comparison to our previous work on semi-dilute linear chains, ring polymers exhibit large fluctuations in fractional extension at steady state extension, indicating strong interactions with the background polymer solution. Transient stretching dynamics of ring polymer is inhibited in semi-dilute linear background, similar to our previous observation in linear systems. Our findings show that topology and concentration play a strong role on polymer chain dynamics in non-equilibrium flow.

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