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Single-molecule studies of DNA self-diffusion in entangled linear and circular DNA blends COLE D. CHAPMAN, UCSD, MICHAEL HARLANDER-LOCKE, University of San Diego, DOUGLAS E. SMITH, UCSD, RAE M. ROBERTSON-ANDERSON, University of San Diego, UCSD PHYSICS TEAM, USD PHYSICS TEAM — Here, we use single-molecule fluorescence and particle-tracking to measure self-diffusion coefficients of single DNA molecules in varying blends of entangled linear and circular DNA. We have previously shown that the self-diffusion of entangled circular and linear DNA differ from each other and are strongly dependent on the topology of the background DNA. This phenomenon can be attributed in part to the tendency of linear polymers to thread their circular counterparts, leading to constraint release, as well as reptation. Previous rheological studies have shown a complex relationship between the ratio of linear to circular polymers and viscosity, however, conflicting results have been reported and the molecular dynamics that lead to this behavior remain unclear. Using single-molecule methods, we can directly measure self-diffusion coefficients for individual DNA molecules within concentrated solutions of linear and circular DNA, and thus determine for both topologies the dependence of self-diffusion on: the ratio of linear and circular species, the overall solution concentration, and the molecular length.

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