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Single Molecule Dynamics of Branched DNA Polymers
DANIELLE MAI, CHARLES SING, CHARLES SCHROEDER, Univ of Illinois - Urbana — This work focuses on extending the field of single polymer dynamics to topologically complex polymers. Here, we report the direct observation of DNA-based branched polymers. Recently, we recently demonstrated a two-step synthesis method to generate star, H-shaped, and comb polymers for single molecule visualization. Following synthesis, we use single-color or dual-color single molecule fluorescence microscopy to directly visualize branched polymer dynamics in flow, in particular tracking side branches and backbones independently. In this way, our imaging method allows for characterization of molecular properties, including quantification of polymer contour length and branch distributions. Moving beyond characterization, we use molecular rheology and single molecule techniques to study the dynamics of single branched polymers in flow. Here, we utilize precision microfluidics to directly observe branched DNA polymer conformations during transient stretching, steady-state extension, and relaxation from high stretch. We specifically measure backbone end-to-end distance as a function of time. Experiments and Brownian dynamics simulations show that branched polymer relaxation is a strong function of the number of branches and position of branch points along the main chain backbone.

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