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Dynamics of DNA Molecules in Slit Microchannels YENG-LONG CHEN, HONGBO MA, MICHAEL GRAHAM, JUAN DE PABLO, University of Wisconsin-Madison — Microfluidic devices used for high accuracy/throughput biochemical analysis could potentially revolutionize genome analysis. As an example, DNA adsorption on microfluidic channel walls has been fruitfully exploited for single DNA restriction mapping. Brownian dynamics simulations accounting for full hydrodynamic interactions (including perturbations from the wall) are employed to investigate the dynamics of a single DNA molecule undergoing pressure-driven shear flow in rectangular channels of height comparable to and less than the radius of gyration of the molecule. Good agreement is found between theory predictions, simulation results, and experimental measurements. Further investigations explore how shear flow may be used to manipulate the chain conformation and transport properties. We also examine how predictions of the chain dynamics and conformation in confined environments are affected by the degree of coarse-graining in the simulated DNA molecule, and propose a novel approach to dynamically optimize the resolution of our models.

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