CHEMICAL ENGINEERING

DISTINGUISHED YOUNG SCHOLARS SERIES

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Single Molecule Studies of Branched Polymer Dynamics

ABSTRACT: In this seminar, I will discuss the synthesis, characterization, and single molecule dynamics of branched polymers. Single molecule studies provide a direct observation of polymer chain dynamics at the molecular level; however, the vast majority of single polymer studies have only focused on linear DNA molecules. Recently, we extended single polymer dynamics to study branched polymers based on comb-shaped DNA. Here, we synthesized branched DNA polymers with varying backbone lengths, branch lengths, and branch frequencies using a hybrid synthetic method. Following synthesis, we use single molecule fluorescence microscopy to characterize conformational dynamics of branched DNA. In one experiment, we study the dynamics of asymmetric star, H-shaped, and comb-shaped DNA polymers tethered to a surface. In this way, we study the impact of branch frequency and position on backbone chain relaxation from high stretch. In a second experiment, we utilize a microfluidic cross-slot device to hydrodynamically "trap" branched DNA molecules in planar extensional flow, thereby studying transient and steady-state dynamics of comb polymers in flow. We present results for branched polymer dynamics as functions of branch frequency and flow strength. In this way, our work will provide a molecular-based understanding of the non-equilibrium dynamics of branched polymers, thereby enabling the development of advanced polymer processing methods.

LECTURE 4:00 – 5:00 (PAA) A110
Happy Hour in Benson Hall Lobby Following

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BIOGRAPHY: Danielle Mai completed her Ph.D. in Chemical Engineering at the University of Illinois at Urbana-Champaign under the guidance of Associate Professor Charles M. Schroeder. Danielle was recognized by several honors during her graduate studies, including an NSF Graduate Research Fellowship and Lam Research Outstanding Graduate Student Award. Danielle received her B.S.E. in Chemical Engineering from the University of Michigan and M.S. in Chemical and Biomolecular Engineering from the University of Illinois. Danielle's work has focused on extending the field of single polymer molecule studies to include branched polymeric materials. This fall, Danielle will pursue postdoctoral research with Associate Professor Bradley Olsen at MIT.