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Tailoring Structure and Flow Properties of Colloidal Suspensions Through Polymer Molecular Weight



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ABSTRACT

Addition of polymers to suspensions of microscale particles can induce the formation of particle clusters, important for processes that require flocculation such as separations or water purification, or networks, useful as feedstocks for 3-D printing. The microscopic interactions between the particles and polymers control the mesoscale and macroscopic behavior of these suspensions: adsorbing polymers induce enthalpic bridging interactions, whereas non-adsorbing polymers induce entropic depletion attractions. Here, I will discuss recent experiments aimed at understanding how the molecular weight of the polymer, which controls the range of the polymer-induced interaction, affects the structure and flow properties of colloid-polymer suspensions. For suspensions with bridging interactions, I will show that polymer molecular weight and concentration affect the structure and dynamics of flocs and networks using a newly-developed model system with bridging interactions that can be tuned through pH. For suspensions with depletion interactions, I will show how polymer molecular weight dictates the mechanism of shear-thickening and alters the extensional flow of dense suspensions.

BIOGRAPHY

Jacinta Conrad is a physical scientist studying transport and dynamics within soft, complex materials and matrices. Using a broad range of microscopy, rheology, scattering, and computational methods, her group seeks to understand how microscale particles, including colloids, nanoparticles, bacteria, viruses, and proteins, explore and/or transport through confined and crowded environments. Insights gained from fundamental studies of these non-equilibrium processes inform the design of materials for rapid prototyping, for preventing fouling and corrosion, for remediating environmental damage, and for sensitively diagnosing disease. She earned an SB in Mathematics from the University of Chicago and MA and PhD degrees in Physics from Harvard. She worked as a postdoctoral researcher in Materials Science and Engineering at the University of Illinois at Urbana-Champaign before starting her faculty position at the University of Houston (UH). Currently, she is the Frank M. Tiller Professor of Chemical Engineering at UH, an Executive Editor at ACS Applied Nano Materials, and Past Chair of the American Physical Society Division of Soft Matter (DSOFT), and was elected a Fellow of the Society of Rheology and the American Physical Society.