ENGINEERING SCIENCES & APPLIED MATH--FEATURED SPEAKER



Large Scale Simulation of Colloidal Hydrodynamics: Heterogenous Particles, Structures and Flow Patterns

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M416 (ESAM Conference Room), Tech

Colloidal gels are formed during arrested phase separation. Sub-micron, mutually attractive particles aggregate to form a system-spanning network with high interfacial area, far from equilibrium. Such networks are useful as soft composites composed of a virtually limitless variety of materials in the particulate and fluid phases. They find applications in food as soft solids like yogurt and cheese, medicine as scaffolds for tissue engineering, and energy as flowable electrodes in flow battery devices. Engineering the growth and response of gels to large deformations is a central effort in all these applications. Models for microstructural evolution during colloidal gelation have often struggled to match experimental results with long standing questions regarding the role of hydrodynamic interactions among the suspended particles. In the present work, I discuss computational models of gelation incorporating hydrodynamic interactions, compare experimental measurements of the linear viscoelasticity in model colloidal gels with calculations of the same, and examine the response of colloidal gels to simple shear flow. I will show how large-scale anisotropies and heterogeneities emerge during the flow attractive colloids and discuss the microhydrodynamic mechanism that stabilizes these heterogeneities. Simple scaling models are employed to understand the engineer-able features of the inter-particle interaction that enable control of these flow induced phenomena