Chemical Engineering

Spring 2022 Seminar Series

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Engineering the Interfacial Friction of Soft Materials

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Friday, April 29, 2022
3:00pm, 66-110
and live-streamed

Abstract: The need to engineer interfacial friction is increasingly important in technologies as diverse as soft robotics and consumer products. The first part of the talk focuses on the role of particle roughness in the rheology, structure, and dynamics of dense colloidal suspensions. Rough colloids at maximum packing, unlike hard sphere systems, retain strong rheological memory and shear thickening properties that could be leveraged to create impact resistant soft materials. We analyze these unusual rheological phenomena using direct visualization from confocal rheometry, glass transition and hydrodynamic models, and the reduced mobility of interlocked particles. The second part of the talk focuses on our group's recent work on bioinspired soft materials. We investigate the effect of material chemistry as well as pattern geometry on the sliding friction of elastomer and hydrogel surfaces separated by very thin fluid layers. Using a semi-analytical lubrication and elasticity model that accounts for the compression and bending of patterns, it is possible to accurately predict the interfacial friction experienced by humans and robot fingers sliding across wet textured materials. Our long-term vision is to create new frontiers in haptic science through the physico-chemical design of colloidal and polymeric materials.