Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Modeling and Stokesian-Dynamics Simulations of Friction in Colloidal Suspensions[1] GERALD WANG, MIT Chemical Engineering; CMU Civil and Environmental Engineering, JAMES SWAN, MIT Chemical Engineering — As the gap between particles in a suspension approaches zero, inter-particle frictional forces can become non-negligible. These forces may strongly influence structure and transport in systems with a significant number of particle-particle contacts, such as sticky colloid suspensions. Understanding the influence of microscopic frictional contacts on macroscopic suspension properties is vital for modeling many rheological phenomena, including discontinuous shear thickening. In this talk, we present computational and theoretical work exploring the role of friction in colloidal suspensions, in which friction is treated as a hydrodynamic resistance to sliding between particles near contact. Our Stokesian-Dynamics simulations demonstrate that the frictional suppression of both the translational and rotational diffusivities can be related to the friction coefficient using a simple power-law scaling. To explain this result, we develop a spectral model that quantifies the impact of friction on the hydrodynamic resistance tensor. We then show that a mathematical model of the suspension as a graph, which tracks connections between neighboring particles, can be used to explain the observed dynamics. We also discuss connections between our work and several recent experimental results.

[1]NSF CREST Award #1735968

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Date submitted: 31 Jul 2019 Electronic form version 1.4