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Microstructure in Concentrated Sheared Dispersions JEFF MORRIS, EHSSAN NAZOCKDAST, City College of New York — This work describes a theory for predicting microstructure of concentrated colloidal hard spheres as a function of Péclet number $Pe = 6\pi\eta\dot{\gamma}a^3/kT$ and particle volume fraction, ϕ; $\dot{\gamma}$ is the shear rate, a is the particle radius, η is fluid viscosity and kT is the thermal energy. We study the pair distribution using the pair Smoluchowski equation. Many-body effects in the conservation equation were then formulated self-consistently through probabilistic third-particle integrals, with emphasis on capturing the interaction of flow and excluded volume effects. The resulting integro-differential equation was solved iteratively. Comparison between theory predictions and simulation results show that the theory is able to predict known near-equilibrium ($Pe \ll 1$) and dilute-suspension large-Pe results. The approach accurately predicts the major features of microstructure at concentrated ϕ under strong shear, which differentiates it from previous theoretical work. Rheological quantities of shear stress, normal stress differences, and particle pressure are computed from the structure.

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