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Brownian Particles Under Shear: Rheology & Microstructure[1]
SOMAYEH FARHADI, MADHURA GURJAR, University of Pennsylvania, NATHAN KEIM, California Polytechnic State University - San Luis Obispo, PAULO ARRATIA, University of Pennsylvania — We present 2D rheological experiments of dense suspensions of Brownian (1 μm) particles. The particles, which are purely repulsive, are adsorbed at an oil-water interface and are sheared periodically by a magnetized needle. The area fraction of the sample is kept fixed at approximately 40%, which is above its glass transition. We measure the bulk rheology at low strain amplitudes while simultaneously track the particles in order to understand the microstructural contributions to yielding and plasticity in thermal systems. Previous studies on nonthermal colloids (of size 4-6 μm) identified a regime, below yielding point, where localized regions of space with reversible cycles undergo plastic deformations. For thermal systems, we anticipate to observe a transition from plastically reversible to irreversible states as the Pclet number (which characterizes the shear-induced to diffusion-induced displacements) is decreased. We also investigate the directional diffusion of particles by probing anisotropy of the diffusion matrix, which gives us information on how the thermal and convective effects add up for highly packed systems.

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