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Rheology and particle dynamics near the flow-arrest transition: a constant stress and pressure approach MU WANG, JOHN BRADY, California Institute of Technology — We use Brownian dynamics to investigate the relation between the rheology and the microscopic particle dynamics in dense colloidal dispersions at constant stress and pressure. For each imposed stress/pressure pair, the suspension exhibits distinct strain rate distributions depending on the observation time. We measure the long-time self-diffusivity (LTSD) corresponding to the strain rate (inverse shear viscosity) and find that the LTSD results at different imposed stresses collapse to master curves that depends only on the imposed pressure. For low-pressure suspensions, the stress-scaled LTSD diverges at a finite scaled strain rate due to its liquid-like behavior, while at high pressures the scaled LTSD emerges from zero due to the flow-arrest transition. On the other hand, we discover that the particle friction coefficient—the ratio of the particle shear stress to the particle (osmotic) pressure—is proportional to the strain rate scaled by the LTSD for *all* flowing suspensions. Our results demonstrate the effectiveness of the constant stress and pressure approach for dense suspension rheology, and show that, although the flow of amorphous materials is inherently far-from-equilibrium without a linear response regime, a mean-field description should remain valid.

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