MAR17-2016-020270

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Stress correlations in the transition region of discontinuously thickening suspension flows[1]

JEFFREY MORRIS, CUNY City College of New York

In concentrated suspensions of particles in liquids, the apparent viscosity and the normal stresses are often found to undergo an abrupt transition from a low-viscosity to a high-viscosity state. This behavior happens in a range of materials, for example dispersions of sub-micron spheres in organic liquids to 20-micron diameter corn starch particles in water. While the mechanism may differ for different materials, one scenario which is able to explain this type of behavior is that as the shear stress increases, a stabilizing force which maintains liquid-filled gaps between the particles transitions to one in which contact occurs and frictional interactions between the particles plays a role.

This lubricated-frictional transition is explored using an established simulation approach for spherical particles in viscous liquid [1,2]. The behavior will first be shown to exhibit a shear rate- or stress-induced transition which has features of a classical phase transition. The point equivalent to a critical point is thus the point at which the variation of the shear stress (and typically also the mean particle normal stress) with respect to the shear rate becomes infinite. This point is associated with a pairing of solid fraction and friction coefficient , ϕ and μ respectively. The temporal fluctuations and spatial correlations of the mixture stress are examined and shown to exhibit a striking change as this transition is crossed.

1. R. Mari, R. Seto, J. F. Morris M. M. Denn 2014 Shear thickening, frictionless and frictional rheologies in non-Brownian suspensions *J.* Rheol. **58**, 1693.

2. R. Mari, R. Seto, J. F. Morris M. M. Denn 2015 Discontinuous shear thickening in Brownian suspensions by dynamic simulation. *P*roc. National Acad. Sci. **112**, 15326.

[1]NSF 1605283