Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Effects of inertia on the steady shear rheology of concentrated emulsions: sign reversal of normal stress differences[1] PRIYESH SRIVASTAVA, University of Delaware, KAUSIK SARKAR, George Washington University — The shear rheology of moderately concentrated emulsions (5-27% volume fraction) in the presence of inertia is numerically investigated. Typically, an emulsion of viscous drops experiences positive first normal stress difference (N_1) and negative second normal stress difference (N_2), as has also been predicted by perturbative analysis (Choi-Schowalter model) and numerical simulation. However, recently using single drop results we have shown [Li and Sarkar, 2005, J. Rheo, 49, 1377] that introduction of inertia reverses the signs of the normal stress difference in the dilute limit. Here, we numerically investigate the effects of interactions between drops in a concentrated system. The simulation is validated against the dilute results as well as analytical relations. It also shows the reversal of signs for N_1 and N_2 for small Capillary numbers above a critical Reynolds number. The physics is explained by the inertia-induced orientation of the individual drops in shear. Increasing volume fraction increases the critical Reynolds number at which N_1 and N_2change sign. The breakdown of linearity with volume fraction with increasing concentration is also analyzed.

[1]Partially supported by NSF.

Kausik Sarkar
George Washington University

Date submitted: 10 Aug 2012 Electronic form version 1.4