Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Rheology of a suspension of non-linear elastic particles in a viscous shear flow HOWARD HU, TONG GAO, PEDRO PONTE CASTANEDA, University of Pennsylvania — The rheology of a suspension of two-dimensional (2D) non-linear elastic particles in a Newtonian viscous shear flow is studied. The particles are assumed to be neutrally buoyant and composed of neo-Hookean material.The deformation of the particle is governed by the Reynolds number (Re) and the Capillary number (Ca). In the Stokes flow regime, the particle deforms into a steady elliptic shape while material points inside experiencer a tank-treading like motion. In the dilute limit, a perturbation analysis is performed for a slightly deformed particle in a infinite media to calculate the effective properties of the mixture. 2D Einstein viscosity for rigid particle is recovered at the leading order. For particles with large deformation, the effective stress components and viscosity are calculated by assist of a numerical simulation. A monolithic finite element solver which uses Arbitrary Lagrangian-Eulerian moving mesh technique is implemented to solve the velocity, pressure and stress in both fluid and solid phase simultaneously. The results are also compared with previous works on linear elastic or viscoelastic particles in a viscous liquid.

Tong Gao
University of Pennsylvania

Date submitted: 06 Aug 2009 Electronic form version 1.4