Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

The Rheology and Microstructure of Dense Suspensions of Elastic Capsules[1] JONATHAN CLAUSEN, Sandia National Labs, DANIEL REASOR, CYRUS AIDUN, Georgia Institute of Technology — We use a recently developed hybrid numerical technique [MacMeccan et al. (2009)] that combines a lattice-Boltzmann (LB) fluid solver with a finite element (FE) solid-phase solver to study suspensions of elastic capsules. The LB method recovers the Navier-Stokes hydrodynamics, while the linear FE method models the deformation of fluid-filled elastic capsules for moderate levels of deformation. The simulation results focus on accurately describing the suspension rheology, including the particle pressure, and relating these changes to changes in the microstructure. Simulations are performed with hundreds of particles in unbounded shear allowing an accurate description of the bulk suspension rheology and microstructure. In contrast to rigid spherical particles, elastic capsules are capable of producing normal stresses in the dilute limit. For dense suspensions, the first normal stress difference is of particular interest. The first normal stress difference, which is negative for dense rigid spherical suspensions, undergoes a sign change at moderate levels of deformation of the suspended capsules.

[1]Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. DoE's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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Date submitted: 09 Aug 2010 Electronic form version 1.4