Meeting: 1005, Newark, Delaware, SS 7A, Special Session on Frontiers on Complex Fluid Flows: Analytic and Computational Methods

1005-76-161 **Kausik Sarkar*** (sarkar@me.udel.edu), Mechanical Engineering, University of Delaware, Newark, DE 19716, and **Xiaoyi Li** (lix@me.udel.edu), Mechanical Engineering, University of Delaware, Newark, DE 19716. *Rheology of emulsion of viscous drops at finite Reynolds number.*

We numerically investigate the rheological response of an emulsion in steady and oscillating linear flows at finite Reynolds number. Till date, research on drop deformation and rheology has mostly been restricted to inertia-less flows and small deformation. We use Front-tracking method to compute deformation of arbitrary magnitude at finite inertia. Stresses are computed using Batchelor's formula. Drop-drop interactions are neglected. The relation between excess stress and imposed strain rate are investigated varying interfacial tension, inertia and frequency. For steady shear, a small amount of shear thickening and change of sign of normal stress differences are observed with increased inertia. For oscillating extensional flows, the stress-strain relation is a function of the phase between the drop deformation and the imposed flow. At low Reynolds number, the simulation recovers the linear oscillatory rheology (loss and storage moduli) of Oldroyd and Bousmina. At low surface tension, stress is predominantly elastic, while at high surface tension it is viscous. Increased drop inertia leads to resonance and complex phase in deformation. The resulting excess interfacial stress displays a non-monotonic variation with frequency and obtains a negative elastic modulus at low frequency. (Received February 07, 2005)