Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Surfactant Effects on Drops Rising in Tubes YUANYUAN CUI, NIVEDITA GUPTA, University of New Hampshire — We present our numerical results for the motion of viscous drops rising in cylindrical capillaries at finite Reynolds numbers. A hybrid volume-of-fluid method with a front-tracking scheme is implemented to explore the effects of Bond number, Weber number, and viscosity of the drop phase on the steady shapes and terminal velocities of drops. As the Bond number increases, drops become more deformed. At higher Weber numbers, a reentrant cavity is found at the rear of the drop. Increasing the viscosity of the drop phase reduces the terminal velocity since the resistance of the drop to the ambient fluid increases. We also present the results of adding soluble surfactants in the adsorption-desorption limit in the two-phase system to study the effects of surfactant concentration on the drop motion. The surfactants are modeled using a Langmuir adsorption framework. The non-uniform distribution of surfactants along the fluid interface generates Marangoni stresses that retards the motion of drops and depends on the initial coverage of surfactants. We investigate the effect of mass transfer kinetics on drop deformation and mobility.

Nivedita Gupta
University of New Hampshire

Date submitted: 07 Aug 2009 Electronic form version 1.4