Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Rod-like microparticles at interfaces: near-field capillary interactions and implications for mechanics of particle-laden interfaces LORENZO BOTTO, LU YAO, MARCELLO CAVALLARO, KATHLEEN J. STEBE, Chemical and Biomolecular Eng. Dept. University of Pennsylvania, STEBE'S LAB TEAM — Rod-like particles assemble at fluid interfaces owing to anisotropic capillary interactions. Experiments on cylindrical and ellipsoidal particles reveal that preferred orientation, interaction strength, and properties of resulting assemblies depend strongly on particle shape. While cylinders assemble end-to-end forming rigid linear chains, ellipsoids form flexible structures with particles side-by-side. Simulations of pairs of particles at contact reveal that chains of cylinders are rigid. Experiments bear this out: a chain of microcylinders rotated via a magnetic field remains rigid even under torques in excess of $10^5 kT$. Above a yield stress, chains snap and dissipate stored capillary energy. Interactions between ellipsoids are comparatively weak, with no energy barrier as particle rotate about each other, consistent with the highly flexible chains formed by these particles. These interactions have profound implications for the mechanics of particle-laden interfaces including their viscoelastic properties.

Lorenzo Botto
Chemical and Biomolecular Eng. Dept. University of Pennsylvania

Date submitted: 01 Aug 2011 Electronic form version 1.4