Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Shear-induced ordering and vitrification of concentrated emulsions JUNG-REN HUANG, THOMAS G. MASON, University of California-Los Angeles — Using time resolved light scattering, we investigate the degree of droplet deformation and ordering within concentrated oil-in-water emulsions subjected to oscillatory shear between parallel glass plates. We create uniform microscale droplets between the plates by rupturing a premixed emulsion of larger droplets at a fixed strain amplitude and frequency. Subsequently, by independently adjusting the strain amplitude and frequency and recording videos of the dynamic scattering pattern, we examine how the instantaneous applied shear and prior shear history influence the positional structure of the droplets. We also explore how the ordering of the emulsion droplets depends on the oil volume fraction, both above and below that associated with maximally random jamming of uniform hard spheres. The short-range stabilizing repulsion between oil droplets enforces ordering in the shear direction; yet, by contrast to sheared colloidal hard spheres, the deformability of the oil droplets allows concentrated emulsions to un-jam at sufficiently high shear rates. We propose a real-space model, based on the form factor of ellipsoidal droplets and structure factor of ordered, jammed, and un-jammed configurations, that is consistent with the observed light scattering patterns. This technique can be used to transform the structure of a uniform emulsion between ordered and disordered droplet configurations.

Jung-Ren Huang
University of California-Los Angeles

Date submitted: 27 Nov 2007 Electronic form version 1.4