Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Mechanisms of Reversible Shear Thickening in Concentrated Colloidal Dispersions NORMAN WAGNER, Center for Mol. & Eng. Thermodynamics, Dept. of Chemical Engineering, Univ. Delaware, Newark, DE 19711 — Experimental studies on model systems of colloidal and nanoparticles dispersions of spherical, elliptical and plate-like particles, where both rheology and mictrostructure are measured, are summarized and compared to illustrate the salient features of reversible shear thickening in well-defined model systems. Reversible shear thickening is shown to be stress-controlled and a connection between the transition from "continuous" to "discontinuous" shear thickening and underlying thermodynamic phase transitions (liquid-crystal, and liquid- nematic) is demonstrated. Theoretical models based on particle micromechanics which include lubrication hydrodynamics are shown to successfully predict the onset of reversible shear thickening. Small angle neutron scattering and light scattering measurements indicate the formation of "hydroclusters" as the source of the increased viscous dissipation and validate the micromechanical modeling. A comparison is made between reversible shear thickening and jamming in concentrated colloidal and nanoparticles dispersions under shear and extensional flows.

Norman Wagner
Univ. Delaware

Date submitted: 07 Dec 2005 Electronic form version 1.4