Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Dynamical Phases and Rheology of Rod-Sphere Nanoparticle Mixtures RYAN JADRICH, KENNETH SCHWEIZER, University of Illinois at Urbana-Champaign — Colloidal mixtures involving sticky nonspherical particles that form glasses and gels are relatively unexplored compared to their single component analogs. We develop and apply a microscopic statistical dynamical approach (mode coupling and nonlinear Langevin equation theories) at the center-of-mass level for dense isotropic mixtures of spheres and rods as a function of (short range) attraction strength, aspect ratio, and composition. Based on the mixture structural pair correlations as input, up to seven dynamical phases (transiently localized states with activated dynamics) are predicted corresponding to fluid, repulsive glass, attractive glass, gel, a mixed coexisting glass-gel state, and several partially localized states. The dynamical complexity increases with aspect ratio, and reflects a rich competition between repulsive force caging, physical bond formation and rod interpenetration. Removal of the nanosphere attraction destroys the double gel state but otherwise has minor consequences. The elastic shear modulus and absolute yield stress are also studied, and order of magnitude changes are found along various trajectories in the dynamical phase diagram. Rods are found to generically impart greater bulk rigidity than spheres.

Ryan Jadrich
University of Illinois at Urbana-Champaign

Date submitted: 04 Nov 2011 Electronic form version 1.4