Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Kinetic arrest and activated relaxation in dense suspensions of attractive nonspherical colloids RUI ZHANG, KENNETH SCHWEIZER, University of Illinois at Urbana-Champaign — The coupled translation-rotation activated dynamics in dense suspensions of uniaxial short-range attractive homogeneous (hDC) and Janus (JDC) dicolloids are studied using the microscopic nonlinear Langevin equation theory based on the concept of a dynamic free energy surface. For larger aspect ratios, three activated regimes, repulsive glass (RG), attractive glass (AG) and gel (G), are predicted where translation and rotation are always strongly coupled. Physical clustering in the JDC system suppresses the re-entrant RG-fluid(F) process. For hDCs of small enough aspect ratio, multiple kinetic arrest transitions, novel re-entrant phenomena, and a dynamical quadruple point emerge associated with F, G, RG, AG, and plastic glass (PG) states. Colloid translational and rotational motions are strongly coupled in the gel, but decoupled (slower translation) in the other activated regimes due to the presence of two distinct hopping processes. Both translation and rotation activated relaxation rates are non-monotonic functions of attraction strength at high volume fractions. Translation-rotation decoupling universally weakens as attraction strength grows, and exhibits a different volume fraction dependence at low, intermediate, and high attraction strengths.

Rui Zhang
University of Illinois at Urbana-Champaign

Date submitted: 05 Nov 2011 Electronic form version 1.4