Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Jamming and Phase Transition in Binary Soft Colloids
AKANKSHA AGRAWAL, School of Chemical and Biomolecular Engineering, Cornell University, HSIU-YU YU, School of Chemical and Biomolecular Engineering, University of Pennsylvania, SAMANVAYA SRIVASTAVA, LYNDEN A. ARCHER, School of Chemical and Biomolecular Engineering, Cornell University, SURESH NARAYANAN, Advanced Photon Source, Argonne National Laboratory — We report on jamming, yielding, and flow of binary mixtures of self-suspended silica nanoparticles densely grafted with Polyethylene glycol (PEG)(MW $\sim$ 5000g/mol). The ratio of volume fraction of the larger particles to the total volume fraction of the silica cores, x_L, is shown to sensitively affect both the yielding and jamming transitions of these systems. For all the binary systems a two-step yielding is observed in oscillatory shear measurements, which we discuss in terms of the breaking of small and big particle cages. We find that addition of larger particles to a suspension of smaller ones softens the suspensions and, for small values of the particle radius ratio $r = R_s/R_L$, the larger particles produce complete fluidization of their smaller counterparts. We show that these behaviors coincide with a speeding-up of de-correlation dynamics of all particles in the suspensions using XPCS measurements and are preceded by an abrupt transition in the average inter-particle spacing, similar to behavior predicted for a semi-dilute binary hard sphere suspension model as observed from SAXS experiment.

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Date submitted: 11 Nov 2014 Electronic form version 1.4