Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Elasticity and microstructure of colloidal gels undergoing strain-induced yielding LILIAN HSIAO, RICHMOND NEWMAN, SHARON GLOTZER, MICHAEL SOLOMON, University of Michigan — The mechanism of yielding in colloidal gels, particularly for high strain-rate deformations that are typical of materials applications, is not fully understood. Here, we examine the oscillatory response and stress relaxation of a colloidal gel formed by short-range depletion interactions to find a correlation between the macroscopic rheological behavior and their microstructural features. We use confocal laser scanning microscopy to directly observe the strain-dependent evolution of 3D gel structure within a shearing device. The gels are made up of monodisperse poly(methyl methacrylate) spheres of different sizes and volume fractions dispersed in refractive index matched solvents. We impose simple shear flows of various strains on the gel and observe the 3D structural change after deformation. This is done using a UV light-activated photopolymer, which allows particle configurations to be locked in place rapidly (<0.6s) after yielding. We characterize the transition from a dense network to interconnected clusters using the contact number distribution. Our results show that rigid, stress-bearing clusters play an important part in contributing to the gel elasticity at large strains.

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Date submitted: 11 Nov 2011 Electronic form version 1.4