Polymer Nanocomposite Mechanical Properties as a Function of Nanoparticle Dispersion[1] JOSEPH MOLL, Columbia University, SHUSHAN GONG, RALPH COLBY, Pennsylvania State University, DIMITRIS VLASSOPOULOS, IESL-FORTH, SANAT KUMAR, Columbia University — Nanoparticle (NP) dispersion critically affects the properties of polymer nanocomposites (PNCs), especially mechanical properties. Previous work by our group and others has shown optimal material properties occur when particles form a percolated network. Particle dispersion is a function of the interaction between the polymer and nanoparticle surface, and as such is difficult to control as an independent variable. In our previous work, dispersion was controlled via polymer grafts. Thus in order to vary the particle dispersion states the length and density of the grafted chains were necessarily simultaneously varied. Here we consider bare silica nanoparticles, 14nm in diameter, in 97kg/mol poly(2-vinyl pyridine). Although the particles are bare, the dispersion can still be controlled by proper solvent casting of the material; we use varying amounts of pyridine to charge stabilize the particles in solution and thus vary the dispersion state. We use TEM to probe PNP structure and NP dispersion state, and rheology is used to quantify mechanical properties. We look at the recovery of the storage modulus after large amplitude oscillatory shear and use this to probe the mechanism of particle reinforcement. Because the dispersion is an independently controlled variable, we are able to more accurately quantify its effect on nanocomposites.

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Date submitted: 10 Nov 2011   Electronic form version 1.4