Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Controlling the thermomechanical behavior of nanoparticle/polymer films[1] DAN ZHAO, Columbia Univ, DIRK SCHNEIDER, Max Planck Institute for Polymer Research, GEORGE FYTAS, 1) Max Planck Institute for Polymer Research; 2) University of Crete and FORTH, SANAT K. KUMAR, Columbia Univ — Using Brillouin light scattering, we show that the thermomechanical properties of polymer nanocomposite films consisting of silica nanoparticles (NPs) and poly (2-vinylpyridine) (P2VP) critically depend on the casting solvent and thermal annealing. The composite films are solvent cast in either methylethylketone (MEK) or pyridine. In the MEK as-cast films, no remarkable dependence of elastic modulus on particle loading has been found, which suggests poor adhesion between the bound polymer chains and those in the bulk. Further, when the particle loading exceeds 20 wt%, we observe another independently propagating phonon due to local bridging of silica NPs by P2VP chains. In contrast, when pyridine is used, the sound velocity vs. silica contents can be described by effective medium predictions. This implies that, at a mesoscopic scale, silica NPs are homogeneously dispersed in the P2VP matrices, preserving their potential attractions with P2VP. However, after thermal annealing, the solvent effect disappears. Additionally, we study the effect of the presence of NPs on the glass transition temperature (T_g) of the resulting nanocomposites and find only a slight increase (5 K) in T_g for composites with a loading of 45 wt%.

[1] DMR-1006514

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Date submitted: 15 Nov 2013 Electronic form version 1.4