Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

The "Music" of Silica-Poly(methyl methacrylate) Core-Shell Spheres: Eigenvibrations and Mechanical Properties at the Nanoscale
TIM STILL, Max Planck Institute for Polymer Research, Mainz, Germany (still@mpip-mainz.mpg.de), REBECCA SAINIDOU, Universite du Havre, Le Havre, France, GOETZ HELLMANN, Deutsches Kunststoffinstitut, Darmstadt, Germany, GEORGE FYTAS, MPI for Polymer Research; University of Crete and FORTH, Heraklion, Greece — We report on the measurement of elastic vibrational modes (eigenvibrations) in silica–poly(methyl methacrylate) (SiO_2–PMMA) core-shell spheres and corresponding spherical hollow capsules (PMMA) with different particle size (diameter: 232 nm–405 nm) and shell thickness (25 nm–112 nm) using Brillouin light scattering, supported by numerical calculations. [T. Still et al., Nano Lett. **8**, 3194 (2008)] These localized modes allow to access the mechanical moduli of core and shell material. We observe reduced mechanical strength of the porous silica core and for the core-shell spheres a striking increase of the moduli in both the SiO_2 core and the PMMA shell. The peculiar behavior of the vibrational modes in the hollow capsules is attributed to antagonistic dependence on overall size and layer thickness. The present investigation of the acoustical properties of the individual core-shell particles can lead to the use of such nanoscale engineered particles in more eloborate systems to control hypersonic phonons.

Tim Still
Max Planck Institute for Polymer Research, Mainz, Germany

Date submitted: 01 Dec 2008 Electronic form version 1.4