Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Structural Relaxation of 3-Dimensionally Confined Polymer Glasses: Isobaric versus Isochoric Glass Formation YUNLONG GUO, CHUAN ZHANG, RODNEY PRIESTLEY, Department of Chemical and Biological Engineering, Princeton University — We have measured the glassy-state structural relaxation of aqueous suspended polystyrene (PS) nanoparticles and the corresponding silica-capped PS nanoparticles via modulated differential scanning calorimetry. Suspended and capped-PS nanoparticles undergo glass formation and subsequent physical aging under isobaric and isochoric conditions, respectively. To account for glass transition temperature (Tg) changes with confinement, physical aging measurements were performed at a constant value of Tg minus Ta, where Ta is the aging temperature. With deceasing diameter, aqueous suspended PS nanoparticles exhibited enhanced physical aging rates in comparison to bulk PS. At all values of Tg minus Ta investigated, capped-PS nanoparticles aged at reduced rates compared to the corresponding aqueous suspended PS nanoparticles. Due to differences in paths to glass formation, suspended and capped-PS nanoparticles aged to different apparent equilibrium states. We captured the physical aging behavior of all nanoparticles via the Tool, Narayanaswamy, and Moynihan (TNM) model of structural relaxation.

Rodney Priestley
Department of Chemical and Biological Engineering, Princeton University

Date submitted: 19 Nov 2010 Electronic form version 1.4