

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Effect of Free Surface on Physical Aging of Polystyrene Films and Its Connection to Glass Transition Temperature Reductions: Evidence for a Gradient in Dynamics JUSTIN PYE, KATE ROHALD, ELIZABETH BAKER, CONNIE ROTH, Dept of Physics, Emory University — The glass transition and physical aging in nanoconfined polymer films have been heavily studied. Recently there have been an increasing number of studies pointing towards a gradient in mobility emanating from the free surface in these films. Using a new streamlined ellipsometry technique, we have measured the temperature dependence of the physical aging rate Beta for both bulk (2430 nm) and thin (29 nm) polystyrene (PS) films supported on silicon. We find that the thinner films have reduced physical aging rates at all temperatures that are inconsistent with a simple shift in the temperature dependence of Beta corresponding to the shift in Tg observed in these films. The reduced Beta values measured at all physical aging temperatures are consistent with a gradient in dynamics originating from the free surface of the film. Our data is well fit by a simple two-layer model that has been previously employed to explain the Tg reductions in PS thin films, suggesting that the enhanced dynamics present at the free surface are responsible for both effects. The surface layer thickness of this two-layer model, which increases with decreasing temperature, characterizes the depth to which the enhanced mobility at the free surface propagates into the film.

Connie Roth
Dept of Physics, Emory University

Date submitted: 20 Nov 2009

Electronic form version 1.4