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Influence of Residual Stresses from Thermal Expansion Mismatch during Quenching on the Subsequent Physical Aging of Polymer Thin Films JAMES DAVIDHEISER, SUK YOON, CONNIE ROTH, Dept of Physics, Emory University — Physical aging studies in the research literature over the past 15 years have observed large increases in physical aging rate with decreasing film thickness. Surprisingly these effects are observed for micron thick films, an order of magnitude or two larger than thicknesses where nanoconfinement effects on the glass transition and modulus are typically observed. We present physical aging measurements using ellipsometry on polystyrene (PS) films thermally quenched in different states suggesting that the increased physical aging rate with decreasing film thickness may be attributable to residual stresses in these films. For example, we find that 1400 nm thick PS films quenched in a free-standing state exhibit physical aging rates comparable to those for bulk PS measured by dilatometry, while 600 nm thick PS films quenched in a free-standing state exhibit a much faster aging response more comparable to those observed for supported PS films of any thickness. We are working towards correlating the residual stresses due to the thermal expansion mismatch between the film and support with the observed physical aging rates.

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