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Effect of Quench Conditions on the Subsequent Physical Aging Rate of Polymer Glasses LAURA GOLICK, PAUL YOON, ANDY PAHNER, CONNIE ROTH, Dept. of Physics, Emory University — We investigate the stability of polymer glasses when thermally quenched under different conditions. Ellipsometry is used to measure the physical aging rate of polystyrene (PS) films supported or transferred onto silicon wafers. The aging rate quantifies the time-dependent decrease in film thickness that results from the increase in average film density during aging. Although all films are subsequently aged in a supported state, we observe significant differences between films quenched in a free-standing compared to supported state. Films quenched in a free-standing state exhibit a strong thickness dependence to their physical aging rate at micron length scales, an order of magnitude or two larger than thicknesses where nanoconfinement effects on the glass transition and modulus are typically observed. In contrast, supported films do not display any film thickness dependence to their aging rate at this large length scale. This indicates that the physical aging of the material is strongly dependent on conditions during the formation of the glassy state. In an effort to determine the key factors underlying the aging dynamics, we have measured the physical aging rate of supported PS films quenched at various controlled rates. In addition, we have explored the effects of quenching free-standing films held on different frames such that either biaxial or uniaxial stress is applied.

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