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Physical Aging of Polymer Glasses Vitrified under Stress LAURA A.G. GRAY, CONNIE B. ROTH, Dept. of Physics, Emory University — How stress and mechanical deformation impart mobility to polymer glasses has been studied primarily for materials where the glassy state was formed stress free. Here, we investigate the stability of polymer glasses after a constant stress is applied during the formation of the glassy state (thermal quench). We have constructed a unique jig to apply a known stress to free-standing films during the thermal quench. Ellipsometry is used to measure the physical aging rate of polystyrene films transferred onto silicon wafers by quantifying the time-dependent decrease in film thickness that results from an increase in average film density during aging. Stress values above a threshold result in less stable polymer glasses with faster physical aging rates. Initial measurements of the rubbery plateau creep compliance indicate these thin films are stiffer than bulk by two orders of magnitude, consistent with other studies in the literature. However, our results appear to be independent of film thickness over the range studied (150-700 nm). Current efforts are now focused on computer-controlled application of stress and strain during the quench to investigate these unusual material properties in thin films.

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