Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Stress Applied during Vitrification Influencing the Subsequent Physical Aging of Polymer Glasses LAURA A.G. GRAY, CONNIE B. ROTH, Dept. of Physics, Emory University — How stress and mechanical deformation impart mobility to glasses is an active area of study across a range of glassy systems from polymers and small molecules, to colloids and granular materials. Conceptual frameworks such as the jamming phase diagram have been proposed to investigate if stress acts as another independent variable similar to temperature and density (volume fraction). Existing studies have focused primarily on applying stress or strain to a glassy state that has been formed stress free. Here, we investigate the stability of polymer glasses when stress is applied during the formation of the glassy state. We have constructed a jig to apply a known stress to free-standing polymer films during the thermal quench. Ellipsometry is used to measure the physical aging rate of these stress-quenched polystyrene films transferred onto silicon wafers by quantifying the time-dependent decrease in thickness that results from an increase in average density during aging. We observe a transition to a faster aging rate for stresses applied above a critical threshold. We hypothesize that increased stresses may trap the glassy state into higher, less stable potential energy minima resulting in faster aging rates.

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Date submitted: 27 Nov 2012 Electronic form version 1.4