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Physical Aging in Nanoconfined Polymer Films: Importance of 3D vs. 1D Thermal Contraction in the Resulting Physical Aging Response CONNIE B. ROTH, ELIZABETH A. BAKER, Dept. of Physics, Emory University, Atlanta, GA 30322, PERLA RITTIGSTEIN, JOHN M. TORKELSON, Dept. of Chemical & Biological Eng., Dept. of Materials Science & Eng., Northwestern University, Evantston, IL 60208 — Studies of physical aging in confined geometries have reported conflicting observations of changes in physical aging rates with decreasing polymer film thickness. Accelerated physical aging with decreasing film thickness has been observed with gas permeation and ellipsometry in stiff backbone, so-called "high free volume," polymers traditionally used in gas separation membranes. In contrast, no change or suppressed physical aging has been observed with fluorescence in flexible carbon-carbon backbone polymers. We have developed a new streamlined ellipsometry procedure that allows us to relatively quickly ($\sim$6 hrs) evaluate the physical aging characteristics of both stiff and flexible backbone polymers in a thin film geometry. We present measurements of physical aging rates using our new approach and compare these to existing results in the research literature. In addition, we also address the importance of 3D vs. 1D thermal contraction in the resulting physical aging response, which we believe is one of the key factors accounting for the observed qualitative differences in physical aging rate upon confinement between the existing studies.

Connie Roth
Dept. of Physics, Emory University, Atlanta, GA 30322

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