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Intrinsic Friction Analysis of the Glass Forming Process of Polymer Films RENE OVERNEY, SCOTT SILLS, TOMOKO GRAY, University of Washington — Many modern and future technological applications involve ultrathin polymer films with a thickness below the 100-nanometer scale, where statistical bulk averaging is jeopardized and interfacial constraints dictate transport properties. In such confined polymeric systems, transport properties strongly depend on molecular relaxation and structural phases that deviate from the bulk. This is particularly relevant in thermally assisted nanoindentation processes near the glass transition temperature, Tg. In this paper, an elaborate isothermal friction-velocity analysis is introduced, as a material distinctive characterization tool that provides fundamental insight into the glass forming process. It is the glass forming process in constrained thin films that leads to a non-monotonous Tg-profile, which is responsible for a strongly film thickness dependent effective modulus during nanoindentation. The presented study involves ultrathin polystyrene films that serve as model systems in a thermomechanical NEMS storage application designed to circumvent the superparamagnetic limit associated with magnetic data storage.

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