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Frictional Response of Molecularly Thin Liquid Polymer Films Subject to Constant Shear Stress CHARLES TSCHIRHART[1], SANDRA TROIAN, Applied Physics, California Institute of Technology, Pasadena, CA — Measurements of the frictional response of nanoscale viscous films are typically obtained using the surface force apparatus in which a fluid layer is confined between smooth solid substrates approaching at constant speed or force. The squeezing pressure causes lateral flow from which the shear viscosity can be deduced. Under these conditions however, molecularly thin films tend to solidify wholly or partially and estimates of the shear viscosity can exceed those in macroscale films by many orders of magnitude. This problem can be avoided altogether by examining the response of an initially flat, supported, free surface film subject to comparable values of surface shear stress by application of an external inert gas stream. This method was first conceived by Derjaguin in 1944; more recent studies by Mate et al. at IBM Almaden on complex polymeric systems have uncovered fluid layering and other interesting behaviors. The only drawback is that this alternative technique requires an accurate model for interface distortion. We report on ellipsometric measurements of ultrathin polymeric films in efforts to determine whether the usual interface equations for free surface films based purely on continuum models can be properly extended to nanoscale films.

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