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Elastic modulus and surface tension of a polyurethane rubber in nanometer thick films[1] MEIYU ZHAI, GREGORY MCKENNA, Texas Tech Univ — Estane is a kind of polyurethane with thermodynamically incompatible hard and soft segments. In this study the macro and micro properties of Estane have been characterized and compared. The viscoelastic properties of this material in bulk scale have been determined using dynamic rheometry. Time-temperature superposition was found to be applicable for this material, and a master curve was successfully constructed from the dynamic shear responses of G'(ω) and G"(ω). Also a novel nano bubble inflation method was used to obtain the creep compliance of the Estane ultrathin films and the results show stiffening in the rubbery region for the Estane over thicknesses ranging from 110nm to 22nm. The dependence of the rubbery stiffening on film thickness is studied and the relative influences of nano confinement and surface tension effect are analyzed using both a direct stress strain analysis and an energy balance method for the membrane. The contributions of surface tension and nano confinement are considered separately.

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