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Unusual Stiffening and Elastic Response of Polyisobutylene Nanometric Thin Films HEEDONG YOON, CALEB WIGHAM, GREGORY MCKENNA, Chemical Engineering, Texas Tech Univeristy — The TTU bubble inflation technique was used to study the elastic response and unusual stiffening behavior of nanometirc polyisobutylene (PIB) films. Mechanical properties and surface tension of PIB films were measured through the strain-stress response for film thicknesses ranging from 13 nm to 126 nm. The tests were performed at room temperature, far above the glass transition temperature of PIB. It is found that the stiffening increases with decreasing film thickness, while the surface tension is independent of the film thickness. Similar to the prior bubble inflation measurements in polymeric thin films, the thickness dependence of the stiffening followed a power law behavior in this case of $D_s \propto h^{1.5}$. These results are consistent with the Ngai et al [J. Polym. Sci., Part B: Polym. Phys. 2013, 51, 214] proposition that rubbery stiffening is related to the separation of the α relaxation and Rouse modes. In addition, we compare stiffening index (S) with fragility (m) based on our prior observation that the S follows a linear behavior with dynamic m. Unlike other polymeric materials seen in prior bubble inflation measurements [Macromolecule 2015, 48, 6329], the S of PIB does not follow the linear behavior with m.

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