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Direct Measurement of Crazing Mechanics in Polystyrene Thin Films: Molecular Weight Effects SHINICHIRO SHIMOMURA, REED BAY, MARK ILTON, ALFRED CROSBY, University of Massachusetts Amherst — Mechanical properties of polymer thin films are critical to various applications such as protective coatings, electronic devices, and separation membranes. Although methods for measuring the structure and some physical properties, such as T_g, of polymer thin films have been well established, measuring mechanical properties of thin films has not been fully developed and has been largely limited to extremely small strains and complex stress distributions. To overcome these limitations, we have recently introduced a direct measurement technique for quantifying the complete uniaxial stress-strain relationship for polymer thin films. Here, we use 'dog-bone' shaped thin films of polystyrene (PS) to quantify the change in mechanical response as a function of molecular weight. We observe a nonlinear stress-strain relationship, resembling ideal plastic-like behavior, associated with the onset of crazing. We will discuss how the onset stress and critical strain to failure changes as a function of molecular weight. These changes, and the alignment of craze fibrils, are discussed in the context of how entanglement density is altered for confined thin films. These results provide new insight into fundamental molecular physics for polymer thin films.

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