The properties of polymer glasses have been studied classically due to their importance for a wide range of technologies; however, there is increasing need and demand to use these materials in geometries where dimensions approach the length scale of an individual polymer chain. Significant efforts recently have provided insight into how physical properties, especially the glass transition temperature, can change as a function of dimensional confinement; however, there has been significantly less development with regards to mechanical properties, which are especially critical for performance. We present results using two recently-developed experimental methods, called The Uniaxial Tensile Tester for Ultra-Thin films (TUTTUT) and TUFF (Tensile tester for Ultra-thin Freestanding Films), which allow for the direct measurement of the complete stress-strain relationship for uniaxial stretching of ultra-thin polymer films as thin as 12nm. Our results reveal a new, thickness-controlled transition from craze deformation processes to shear deformation zones for films that are less than 30nm in thickness. We relate this deformation mechanism transition to other property changes in bulk and thin film polymer glasses. This method and these results not only provide fundamental insight into the physics of polymer materials but also new opportunities for designing ultra-thin film materials with enhanced performance.