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Wrinkles and Folds in Ultra-Thin Polymer Films[1] YURI EBATA, University of Massachusetts, Amherst, ANDREW B. CROLL, North Dakota State University, ALFRED J. CROSBY, University of Massachusetts, Amherst — Wrinkles and folds are observed in many biological systems during morphogenesis processes. However, the mechanics of how these wrinkles and folds form are not completely understood. Studying the mechanics of wrinkles and folds will not only provide us with fundamental insights of nonlinear deformation processes but also allow for the fabrication of unique patterned surfaces that can be controlled reversibly. In this study, we examine wrinkles and folds of polystyrene films of thickness ranging from 5 nm to 180 nm attached to uniaxially-strained polydimethylsiloxane substrates. The strain is released incrementally to apply increasing compressive strain to the attached film. The wavelength and the amplitude of local out-of-plane deformation are measured as global compression is increased to distinguish between different buckling modes. The transition from wrinkling to folding is observed by tracking the statistics of amplitude distribution sampled across a large lateral area, and a critical strain map is constructed to observe how film thickness affect the resulting buckling modes.

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