

Abstract Submitted  
for the MAR12 Meeting of  
The American Physical Society

**Wrinkling of Inhomogeneously Strained Thin Polymer Films** YU-CHENG CHEN, ALFRED J. CROSBY, University of Massachusetts - Amherst — Surface wrinkles have received much attention recently due to their potential importance in applications. Wrinkles occur due to a mechanical instability when sufficient strain applied to an incompressible thin film. For wrinkles made with a polymer film supported on a soft elastomer, it has been well-established that the amplitude is directly proportional to the wavelength and the square root of the applied strain. Importantly, the wavelength is largely insensitive to the applied strain and defined by the properties of the film and substrate. These dependences have been confirmed with ideal substrates where the global strain is homogeneously distributed, but the influence of strain inhomogeneity has not been considered previously. Will regions that wrinkle first lead to strain localization, or will the system try to homogenize strain globally? We use a recently developed adhesion contact line method to prepare polystyrene thin films with periodic regions of different wrinkle amplitudes, hence strains, on soft substrates. We find that surfaces with multiple wrinkle amplitudes will approach a single amplitude globally upon the application of sufficiently large strains. We derive relationships to describe this process.

Yu-Cheng Chen  
University of Massachusetts - Amherst

Date submitted: 10 Nov 2011

Electronic form version 1.4