

MAR13-2012-008232

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Understanding and Controlling Morphological Transitions of Wrinkles

ALFRED CROSBY, University of Massachusetts Amherst

The ability to generate micron and sub-micron structures across extensive lengths on soft materials surfaces is critical for numerous technologies, yet current fabrication methods do not provide cost-effective solutions for these diverging demands. In Nature, elastic instabilities often are used to produce materials structures on small scales from simple building blocks to achieve necessary performance on larger, macroscopic size scales. We present an overview of our efforts to understand and use elastic instabilities, such as wrinkling and folding, to define surface structures with advantageous properties. In particular, we address two questions related to morphological transitions: the roles of overstress and curvature on selecting the specific wrinkle morphology created under equibiaxial stress conditions; and non-linear transitions, including wrinkle-to-fold, and the suppression of such transitions to achieve high-aspect ratio wrinkle structures. The lessons described provide new insight into the physics of these complex material deformations while also introducing scalable methods that are expected to help transfer elastic instabilities into current technologies.