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High Aspect Ratio Wrinkles YU-CHENG CHEN, ALFRED J. CROSBY, Univ of Mass - Amherst — Wrinkles occur when a compressive strain is imposed on a bilayer system composed of a stiff thin top film and a soft substrate. Wrinkle aspect ratio (wrinkle height divided by wavelength) is perhaps the most critical parameter for many promising wrinkle-based technologies; however, the current accessible range of aspect ratio has been restricted from 0 to 0.35. Within this range, wrinkle aspect ratio is known to increase with increasing compressive strain until a critical strain is reached, at which point wrinkles transition to localizations, such as folds or ridges. Here, we demonstrate the ability to delay this transition and ultimately expand the range of aspect ratios. Building upon recently developed models which link this transition to the asymmetric traction forces between the wrinkle crests and valleys for non-linear strain energy functions, we experimentally quantify the critical strain for both ridge and fold localizations as a function of the substrate material properties, initial stretch ratio, as well as film properties and geometry. Collectively, we demonstrate the ability to achieve wrinkle aspect ratios as large as 0.8, demonstrating significant promise for future wrinkle-based applications.

Yu-Cheng Chen
Univ of Mass - Amherst

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