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High Aspect Ratio Wrinkles YU-CHENG CHEN, ALFRED CROSBY, University of Massachusetts Amherst — Buckling-induced surface undulations are widely found in living creatures, for instance, gut villi and the surface of flower petal cells. These undulations provide unique functionalities with their extremely high aspect ratios. For the synthetic systems, sinusoidal wrinkles that are induced by buckling a thin film attached on a soft substrate have been proposed to many applications. However, the impact of the synthetic wrinkles have been restricted by limited aspect ratios, ranging 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 period doublings. Inspired by the living creatures, we propose that wrinkles can be stabilized in high aspect ratio by manipulating the strain energy in the substrate. We experimentally demonstrate this idea by forming a secondary crosslinking network in the wrinkled surface and successfully achieve aspect ratio as large as 0.8. This work not only provides insights for the mechanism of high aspect ratio structures seen in living creatures, but also demonstrates significant promise for future wrinkle-based applications.

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