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Pattern zoology in biaxially pre-stretched elastic bilayers: from wrinkles and creases to fracture-like ridges RASHED AL-RASHED, FRANCISCO LOPEZ JIMNEZ, PEDRO REIS, Massachusetts Institute of Technology — The wrinkling of elastic bilayers under compression has been explored as a method to produce reversible surface topography, with applications ranging from microfluidics to tunable optics. We introduce a new experimental system to study the effects of pre-stretching on the instability patterns that result from the biaxial compression of thin shells bound to an elastic substrate. A pre-stretched substrate is first prepared by pressurizing an initially flat elastomeric disk and bulging it into a nearly hemispherical thick shell. The substrate is then coated with a thin layer of a polymer suspension, which, upon curing, results in a thin shell of nearly constant thickness. Releasing the pre-stretch in the substrate by deflating the system places the outer film in a state of biaxial compression, resulting in a variety of buckling patterns. We explore the parameter space by systematically varying the pre-stretch, the substrate/film stiffness mismatch, and the thickness of the film. This results in a continuous transition between different buckling patterns, from the dimples and wrinkles that are traditionally associated with the buckling of elastic bilayers, to creases and high aspect ratio 'fracture-like' ridges, where the pre-stretch plays an essential role.

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