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Primary and secondary bifurcations in compressed elastomeric bilayers with small modulus contrast ANESIA AUGUSTE, University of Massachusetts Amherst, LIHUA JIN, ZHIGANG SUO, Harvard University, RYAN C. HAYWARD, University of Massachusetts Amherst — Elastic materials undergo various kinds of elastic instabilities when subjected to compression. The primary bifurcation behavior for a stiff thin film on a thick soft substrate is wrinkling, whereas for a homogeneous material it is creasing. While ideal bilayered systems with large contrasts in modulus and thickness are well understood, many system in nature and engineering contexts are far from this simple case. We have developed an experimental system to systematically vary the modulus contrast, complemented by finite element simulations, to study the primary and secondary bifurcations in compressed bilayers. We find that below a ratio of film to substrate elastic modulus of approximately 2, the primary bifurcation is creasing. For slightly larger contrasts, the primary bifurcation is wrinkling but there are two distinct types of secondary bifurcations: (1) wrinkles that transition into creases without period-doubling; and (2) wrinkles to creases preceded by period doubling. Understanding surface instabilities in such non-ideal bilayer systems provides important insights on the behavior of biological tissues and other systems with a small modulus contrast.

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