Branched wrinkles in inhomogeneous film-on-substrate systems

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We model the post-buckling behavior of wrinkles in thin solid films supported by inhomogeneous substrates under uniaxial deformation. On homogeneous substrates, the preferred wave vector of the wrinkles points along the stretching direction, which represents an inherent anisotropy, and the wavelength is determined by the elasticities of the film vs. the substrate. In turn, a spatial variation of the substrate elasticity perpendicular to the anisotropy, as recently studied experimentally by B. Glatz et al. [1], triggers the formation of branched wrinkle patterns with spatially varying wave numbers. By modeling wrinkling on substrates with either a step-like or linearly ramped variation of stiffness (i.e. elastic modulus), we find in the post-buckling regime a coexistence of many branched wrinkle patterns having different wave numbers and different densities of branching points, and being stable at identical parameters : the selected pattern depends on the initial conditions [2]. The stability range of branched patterns is narrower for smooth compared to steep stiffness changes, and the ordering of the branching points depends on the length scale of the stiffness variation.

Références

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