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Surface wrinkling in liquid crystal elastomer bilayers[1] ADITYA AGRAWAL, Rice University, PAUL LUCHETTE, Kent University, WALTER CHAPMAN, Rice University, PETER MUHORAY, Kent University, RAFAEL VERDUZCO, Rice University — Mechanically-induced surface wrinkling patterns, also known as strain-induced elastic buckling instability for mechanical measurements (SIEBIMM), represent a versatile and high throughput technique for thin film metrology. However, the technique requires clamping and mechanically straining bilayer samples, which can introduce errors and present challenges with small samples. Here, we present a modified approach in which thin films are deposited on top of a stimuli-responsive liquid crystal elastomer (LCE). Temperature changes induce a spontaneous and controllable shape-change in the LCE substrate, without the need for clamping or mechanically straining. We show that LCE bilayers can be used to accurately measure the modulus of nanoscale poly(styrene) films, down to 20 nm thick films. Furthermore, the surface wrinkle orientation can be controlled using different preparation methods and reoriented in a single sample with temperature changes only. In the case of thick (over 500 nm) PS films, the bilayer flexes in response to temperature changes. This work shows that LCE bilayers are useful systems for thin film metrology and controlled assembly using well-defined surface structures.

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