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Mechanical Characterization of Photo-crosslinked, Thermoresponsive Hydrogel Thin Films via AFM Nanoindentation[1] THAO LE, School of Natural Science, Hampshire College, KATHERINE AIDALA, Department of Physics, Mount Holyoke College, RYAN HAYWARD, Department of Polymer Science and Engineering, University of Massachusetts Amherst — Thin hydrogel films with patterned swelling are known to buckle into programmed three-dimensional shapes, offering approaches to fabricate reversibly self-folding micro-devices for actuators and drug delivery devices. To precisely control the shapes adopted, it is important to quantitatively understand the relationship between swelling and mechanical properties. Furthermore, to understand the buckling pathways and the mechanical responses of the swelled materials, it is also important to identify how the gels undergo stress relaxation. However, the low moduli, high water contents, and micrometer-scale thicknesses of these materials have so far made mechanical characterization difficult. In this study, we use an AFM nanoindentation technique to characterize the mechanical properties of photo-crosslinked, thermoresponsive poly(N-isopropylacrylamide) hydrogel thin films. Simultaneously, we conduct stress relaxation experiments at microscopic indentation lengths to differentiate between the effects of viscoelastic and poroelastic response mechanisms.

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