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“Surface-Confined, Intelligent Hydrogels”

The overall thrust of our research program is to develop responsive structures without the need for complex circuitry or bulky instrumentation. Our approach is to use polymers that undergo volume-shape changes in response to an external stimulus. The stimulus alters the balance of hydration forces within the polymer network, resulting in changes to the macroscopic properties. In this talk, I will discuss the role of intermolecular forces and how they can be harnessed to control volume-phase transitions in polymer networks. I will also discuss techniques for fabricating surface-confined networks, including soft lithography and photo-lithography strategies, as well as the effect of surface-confinement on the response characteristics of the polymers. Finally, it will be shown how instabilities can be induced in hydrogel microstructures to facilitate reconfigurable topographies with sensing and actuation integrated at the material level. Such reconfigurable surfaces can have important implications for variable adhesion, self-cleaning materials, and separations.