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Waveguiding Actuators Based on Photothermally Responsive Hydrogels YING ZHOU, ADAM HAUSER, NAKUL BENDE, Univ of Mass - Amherst, MARK KUZYK, Washington State University, RYAN HAYWARD, Univ of Mass - Amherst — A simple means to achieve rapid and highly reversible photo-responsiveness in a hydrogel is to combine a thermally-responsive gel such as poly(N-isopropyl acrylamide) (PNIPAM), with the photothermal effect of gold nanoparticles. Relying on such composite gels, we fabricate micro-scale bilayer photoactuators by photolithographic patterning, and demonstrate their controlled bending/unbending behavior in response to visible light. In addition to actuation by flood exposure, 532 nm laser light can be waveguided through a plastic optical fiber to direct it into the photoactuator, providing the possibility for remotely controllable actuators that do not require line-of-sight access. The actuators show large magnitude responses within time-scales of ˜1 s, consistent with the small dimensions of the actuators, but also exhibit smaller-scale responses over much longer times, suggesting the possibility of slow internal relaxations within the network. Based on our study on this bilayer system, we further explore fabrication methods for cylindrical actuators that are able to bend in arbitrary directions.

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