Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Swelling-Driven Shaping of Thermally Responsive Photo-Patterned Gel Sheets MYUNGHWAN BYUN, JUNGWOOK KIM, RYAN HAYWARD, Polymer Science and Engineering Department, University of Massachusetts Amherst, JAMES HANNA, CHRISTIAN SANTANGELO, Physics Department, University of Massachusetts Amherst — Swelling-mediated shaping of patterned non-Euclidean plates offers a powerful route to design and engineer complex 3-D structures, with possible applications in biomedicine, robotics, and tunable micro-optics. We have studied the behavior of poly(N-isopropyl acrylamide) (PNIPAm) copolymers containing pendent benzophenone units that allow the degree of crosslinking to be tuned by varying the dose of ultraviolet light. A halftone (gray) gel lithography approach, wherein two photomasks enable patterning of highly-crosslinked domains within a lightly-crosslinked matrix, is shown to provide effectively continuous variations in swelling in truly two-dimensional patterns. We show how this technique can be harnessed to form complex, reversibly actuating, 3-D structures through patterned growth.

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Date submitted: 27 Nov 2011 Electronic form version 1.4