Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Design and Simulation of Optically Actuated Bistable MEMS

THOMAS LUCAS, EVGENIYA MOISEEVA, CINDY HARNETT, University of Louisville — In this project, bistable three-dimensional MEMS actuators are designed to be optically switched between stable states for biological research applications. The structure is a strained rectangular frame created with stress-mismatched metal-oxide bilayers. The devices curl into an arc in one of two directions tangent to the substrate, and can switch orientation when regions are selectively heated. The heating is powered by infrared laser, and localized with patterned infrared-resonant gold nanoparticles on critical regions. The enhanced energy absorption on selected areas provides switching control and heightened response to narrow-band infrared light. Coventorware has been used for finite element analysis of the system. The numerical simulations indicate that it has two local minimum states with extremely rapid transition time (<<0.1 s) when the structure is thermally deformed. Actuation at laser power and thermal limits compatible with physiological applications will enable microfluidic pumping elements and fundamental studies of tissue response to three-dimensional mechanical stimuli, artificial-muscle based pumps and other biomedical devices triggered by tissue-permeant infrared light.

Thomas Lucas
University of Louisville

Date submitted: 11 Nov 2011 Electronic form version 1.4