Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Designing Surface Instabilities as Responsive Materials EDWIN CHAN, JEFFREY KARP, ROBERT LANGER, Massachusetts Institute of Technology — Materials with surface properties that respond to external stimuli have potential applications as sensory devices, therapeutic materials and "smart" adhesive coatings. An example of a responsive material is a topographic surface whose pattern length-scale changes drastically in response to a stimulus. A potential approach to creating such a material is to take advantage of the morphological phase transition observed in elastic instability such as surface wrinkles. In this contribution, we present a general strategy to developing a responsive surface that takes advantage of this morphological transition in a poly(ethylene glycol) based elastomer. The responsiveness of this material is designed by the reversible transition between two distinct pattern length-scales; a small length-scale pattern of a microlens array that responds to an osmotic stress and leads to morphological phase transition to a large length-scale wrinkling pattern. Both these pattern length-scales are material's-defined since the microlens array forms naturally as a result of the residual stress that develops during polymerization, while the surface wrinkles forms due to the buckling stress that develops due to the applied osmotic pressure. Finally, we show that this phase transition occurs reversibly and demonstrate potential application of the material as an alternative design of a self-cleaning surface.

Edwin Chan
Massachusetts Institute of Technology

Date submitted: 26 Nov 2007 Electronic form version 1.4