Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Controlling polymer adhesion with surface wrinkles EDWIN CHAN, Massachusetts Institute of Technology, ERICA SMITH, Trinity College, RYAN HAYWARD, ALFRED CROSBY, University of Massachusetts Amherst —
One of nature's solutions in controlling adhesion is through the intelligent design of patterned interfaces. For example, the feet of geckos and some insects are decorated with fibrillar structures designed specifically for locomotion, i.e. enhanced control of adhesion and release. Recently, there have been significant efforts in mimicking these materials to develop synthetic analogs to tailor polymer adhesion. However, challenges such as reusability and fabrication scalability limit the succesful applications of these materials. In this work, we present an alternative approach to the design of a patterned adhesive that utilizes surface wrinkles to contol the adhesion of a poly(n-butyl acrylate) (PnBA) elastomer. Using a probe-type contact adhesion test, we experimentally show that surface wrinkles enhance adhesion of the PnBA elastomer based on a mechanism termed contact line splitting. We demonstrate that the efficiency of this contact line splitting mechanism is coupled with the wavelength of the wrinkles. Furthermore, the geometry of the surface wrinkles facilitates a repeatable interfacial response necessary to function as a reuseable adhesive. Our approach provides a simple and scaleable strategy to the design of patterned adhesives that is amenable to a variety of polymeric materials while facilitating enhanced control of interfacial response.

Edwin Chan
Massachusetts Institute of Technology

Date submitted: 26 Nov 2007 Electronic form version 1.4