Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Crumpling and uncrumpling of thin polymer films MEGAN JUSZKIEWICZ, NARAYANAN MENON, Department of Physics, University of Massachusetts, Amherst, YAO LIN, T.P. RUSSELL, Department of Polymer Science and Engineering, University of Massachusetts, Amherst — With a view to study the forced crumpling of thin elastic sheets, we have developed a procedure for creating thin copolymer films of thickness, $h \sim 50$nm and lateral dimensions $X \sim 1$cm x 1cm. This geometry yields an aspect ratio, $X/h \sim 2\text{x}10^5$, much closer to the theoretical idealization of infinitely thin sheets than can be obtained with macroscopic sheets. Even though the films are exceedingly thin, they are robust enough that they can be mechanically manipulated without tearing. The films are crumpled by forcing them into small volumes. The copolymer is tagged with a fluorescent dye that allows us to study the three-dimensional crumpled structure of the film by confocal microscopy. The film can then be uncrumpled at an oil-water interface to study the statistics of the plastic creases created in the course of the crumpling process. We will also show data on the kinetics of uncrumpling - a little-studied process with many promising applications. We acknowledge support from NSF-DMR 0305936 and the REU program at the polymer science MRSEC at UMass-Amherst

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Date submitted: 01 Dec 2004 Electronic form version 1.4