

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Self-wrinkling of a thin polymer film on a soft elastic substrate

GUILLAUME MIQUELARD-GARNIER, ANDREW CROLL, ALFRED CROSBY, PSE University of Massachusetts, CROSBY RESEARCH GROUP TEAM — We discuss a new method to induce wrinkling in a thin glassy film. In these experiments, a thin polystyrene film is floated onto water and attached to polydimethylsiloxane substrate as it is either pushed into or pulled out of a water bath at a chosen speed and angle. As attachment proceeds, well-aligned wrinkles form parallel to the three point contact line. Several methods (osmotic swelling, thermal expansion, mechanical strain) have been used extensively to induce wrinkling of thin glassy films, with the mechanics of these systems understood through elastic instability theory. The process presented here offers important advantages compared to these methods. The wavelength is controlled by the mechanical properties of the bilayer, consistent with classical wrinkling theory, while the amplitude (or applied strain) is controlled mainly by the speed of the attachment process. Furthermore, wrinkles do not form for speeds exceeding a critical value, theoretically ascribed to a liquid entrainment limit. By controlling the curvature and velocity of the three point contact line, we demonstrate that this method provides a powerful tool for creating localized patterns across laterally extensive lengths.

Guillaume Miquelard-Garnier
PSE University of Massachusetts

Date submitted: 30 Dec 2009

Electronic form version 1.4