MAR14-2013-020314

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

The instabilities of a polymer sheet floating at a fluid interface

NARAYANAN MENON, University of Massachusetts Amherst

The beautiful patterns seen on thin floating polymer sheets have led to a new and broadened understanding of the instabilities of an elastic sheet under tension. I will briefly review this progress, which includes identification of a dimensionless number – the bendability – that demarcates regimes in which the wrinkling instability of the sheet may either be successfully described by conventional post-buckling theory or requires an entirely different scheme of calculation in which the bending energy is negligible. This new understanding throws into relief new puzzles associated with the dynamics of the pattern growth, and with the transition from the wrinkled state to a crumpled state. I will also describe the new opportunities opened up by phenomena at high bendability. These include measurements of surface energies and contact angles on a deformable substrate, a new method for studying the modulus and extensional rheology of a thin polymer film, and techniques for modification of surface properties of a fluid interface. I thank NSF DMR 12-0778 and the NSFon Polymers at UMass Amherst DMR 08-20506 My thanks to J. Huang, H. King, K.B. Toga, T.P. Russell for collaborations on the experiments and to B. Davidovitch, E. Cerda and R. Schroll for theoretical collaborations.