MAR09-2008-000237

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

The macroscopic delamination of thin films from elastic substrates

PEDRO REIS, Massachusetts Institute of Technology

The wrinkling and delamination of stiff thin films adhered to a polymer substrate have important applications in "flexible electronics." The resulting periodic structures, when used for circuitry, have remarkable mechanical properties since stretching or twisting of the substrate is mostly accommodated through bending of the film, which minimizes fatigue or fracture. To date, applications in this context have used patterning of the substrate-film adhesion energy to produce a controlled array of delamination "blisters." However, even in the absence of such patterning, blisters have a characteristic size. We use macroscopic experiments to study what sets the dimensions of these blisters in terms of the material properties, which we explain using a combination of scaling and analytical methods. This points to a novel method for determining the interfacial toughness. Finally, we suggest a number of design guidelines for the thin films used in flexible electronic applications.