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PROCEEDINGS

Peeling by Pulling: Characterizing the Mechanical Behavior of Nanoscale Thin Films

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ABSTRACT

The flexible and clinging nature of ultra-thin films require the understanding of their elastic and adhesive properties in a wide range of circumstances from fabrications to applications. Simultaneously measuring both properties, however, is extremely difficult as the film thickness diminishes to nanoscales. In this talk, I will show our recent work that addresses such difficulties through peeling by vertically pulling thin films off from the substrates (we thus refer to it as "pull-to-peel"). Particularly, we perform in-situ pull-to-peel of graphene and MoS2 films in a scanning electron microscope and achieve simultaneous determination of their Young's moduli and adhesions to gold substrates. This is in striking contrast to other conceptually similar tests available in the literature, including indentation tests (only measuring elasticity) and spontaneous blisters (only measuring adhesion). Furthermore, we show a weakly nonlinear Hooke's relation for the pull-to-peel response of two-dimensional materials, which may be harnessed for the design of nanoscale force sensors or exploited in other thin-film systems.

KEYWORDS

Blister test; thin films; adhesion; indentation; *in situ* SEM

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