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Graphene Blister Adhesion Mechanics[1] NARASIMHA BODETTI, STEVEN KOENIG, JIANLIANG XIAO, SCOTT BUNCH, MARTIN DUNN, University of Colorado — We describe graphene blister configurations to study the elasticity of mono- and multi-layer graphene as well as the adhesion of the blister to an SiO2 substrate. We create blisters by depositing graphene on a chip containing etched cavities of a prescribed volume. The chip is placed in a high-pressure chamber where the cavities are charged to a prescribed pressure. When the chip is removed from the chamber the pressure difference across the membrane causes it to bulge, while the number of gas molecules in the chamber remains constant. As the pressure is increased the membrane continues to bulge and at a critical pressure can delaminate (in a stable or unstable manner) permitting extraction of the adhesion energy from a combination of theory and measurements of the deformed blister configuration. We describe these experiments and develop a thermodynamic model of the system that identifies interesting nonlinear effects as the membranes deform including instabilities, delamination, and adhesion hysteresis, depending on the configurational parameters. We use the theory and experiments together to determine for the first time the adhesion energy between graphene and SiO2, as well as explore the interesting mechanics that occur.

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