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Probing Mechanical Properties of Chemical Vapor Deposition Graphene Membranes Using Indentation Methods GWAN-HYOUNG LEE, Department of Mechanical Engineering, Columbia University, (And) Samsung-SKKU Graphene Center (SSGC), RYAN COOPER, SUNGJOO AN, AREND VAN DER ZANDE, NICHOLAS PETRONE, Department of Mechanical Engineering, Columbia University, SUNWOO LEE, Department of Electrical Engineering, Columbia University, ALEX HAMMERBERG, Department of Mechanical Engineering, Columbia University, CHANGGU LEE, Department of Mechanical Engineering, Sungkyunkwan University, BRYAN CRAWFORD, Nanomechanics Inc., JEFFREY KYSAR, JAMES HONE, Department of Mechanical Engineering, Columbia University — Recent experimental studies have shown that two-dimensional pristine graphene is the strongest material ever measured. We used Atomic Force Microscopy (AFM) and Agilent G200 nanoindenter to measure the mechanical properties of graphene films obtained by Chemical Vapor Deposition (CVD). CVD graphene with different grain size and number of layers were produced in controlled synthetic conditions and transferred onto silicon dioxide substrate with holes of various diameters. Nano-indentation measurement revealed that stiffness and fracture strength of CVD graphene membranes are similar to those of pristine graphene membranes under the condition that suspended graphene membrane is within a single grain boundary without defects. Furthermore, elastic modulus and fracture strength of multi-layer graphene membranes increase with respect to the number of layers.

Sungjoo An
Department of Mechanical Engineering, Columbia University

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