Probing interface interaction in 2-dimensional materials and their heterostructures

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2-dimensional (2D) homo-/hetero-structures built up from layered materials have received growing attention owing to their simple fabrication, straightforward stacking and various types of band alignments. Optical and electrical properties have been investigated intensively to probe the interface coupling in 2D homo-/heterostructures. The mechanical interface interaction, however, has yet to be well studied. Here I will show two approaches, nanoindentation and surface plasmon enhanced Raman scattering, to probe effective modulus and local strain in 2D homo-/hetero-structures, respectively. Both results reflect the weak interlayer interaction in 2D layered structures. First, nanoindentation experiments indicate that the effective 2D modulus of a bilayer structure is lower than the sum of 2D modulus of each layer due to the interlayer sliding. Second, by coating 2D structures with silver or gold nanoparticles, the local strain existing at the metal-2D layer boundary will split the featured Raman peaks, but this splitting effect weakens as the number of layers increases because of the weak interlayer interaction. Our results not only provide mechanical insight to understanding interface interactions in 2D homo-/hetero-structures, but also potentially allow engineering of their properties as desired.

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