Straining Two-Dimensional Materials at Strong Interfaces: The Shear-Lag Model and Experiments

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Abstract

The strain effect in two-dimensional (2D) materials plays a significant role in designing reliable electronic devices, but the relatively weak substrate interface always leads to insufficient stress transfer. Here we present a reinforced interface using formvar for 2D material and substrate system, and analysis the shear behaviors of it using an improved shear-lag model. At this interface, we achieved in graphene by far the largest strain up to 2% in graphene,[1] significantly improved from the previous highest values of 1.3%,[2] and the peak splitting gives a Poisson's ratio in graphene close to the intrinsic value of graphene rather than affected by the underlying substrate. Moreover, using a shear-lag model[3] that includes the interface friction in consideration, the sliding and failure behaviors of this strong interface can be well explained. We believe that these results can provide new insight into the mechanical behaviors of 2D materials and a valuable guidance for designing new generation flexible electronics.

Keywords: **graphene, strong interface, strain, shear-lag model, friction**

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