Nanoscale friction on 2D stacked MoS_2/graphene heterostructures

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Abstract: Stacked two-dimensional heterostructures attract much attention for their exotic electronic and mechanical properties. We investigated the structures and frictional properties of single layer MoS_2 on graphene/SiC(0001) by means of ultrahigh vacuum atomic force microscopy with non-contact and contact modes. Monolayer MoS_2 triangular islands with a size of ~200 nm are prepared by chemical vapor deposition on graphene/SiC(0001), which itself is prepared via SiC surface graphitization at high temperatures. Friction force microscopy at the atomic scale reveals a regime of low friction between the tip apex and the MoS_2 surface, with a friction coefficient ten times higher than that of the monolayer graphene/SiC(0001). MoS_2 islands are easily rotated or translated by the contacting AFM tip [1], while the second layer of graphene is usually stable under scanning. This finding indicates the weak interaction between MoS_2 and graphene. We measured a contact potential difference of ~300 mV between MoS_2 and graphene. This contrast opens the opportunity to tune the friction via bias on MoS_2/graphene heterostructures [2].

Keywords: 2D heterostructures, friction, MoS_2, graphene

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