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Effect of Surface Morphology on Adhesion of Graphene CHANGGU LEE[1], DAE-HYUN CHO, JIN-SEON KIM, TAIYU JIN, JINYOUNG KANG, RENLONG LIU, YOUNGCHAN KIM, Sungkyunkwan University, LEI WANG, GWAN-HYOUNG LEE, JAMES HONE, Columbia University — The friction of graphene on various substrates, such as SiO2, h-BN, graphite, and mica, was investigated to characterize the adhesion level between graphene and the underlying surface. The friction of graphene on SiO2 decreased with increasing thickness and converged around the penta-layers due to incomplete contact between the two surfaces. However, the friction of graphene on an atomically flat substrate, such as h-BN and graphite, was low and comparable to that of bulk-like graphene. In contrast, the friction of graphene folded onto graphite was indistinguishable with that of mono-layer graphene on SiO2 despite the ultra-smoothness of the graphite. The characterization of the graphene's roughness before and after folding showed that the corrugation of graphene induced by SiO2 morphology was preserved even after it was folded onto an atomically flat substrate. In addition, graphene deposited on mica, when folded, preserved the same corrugation level as before the folding event. We found that graphene, once exfoliated from the bulk crystal, tends to maintain its corrugation level even after it is folded onto an atomically flat substrate and that ultraflatness in both graphene and the substrate is required to achieve the intimate contact necessary for strong adhesion.

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