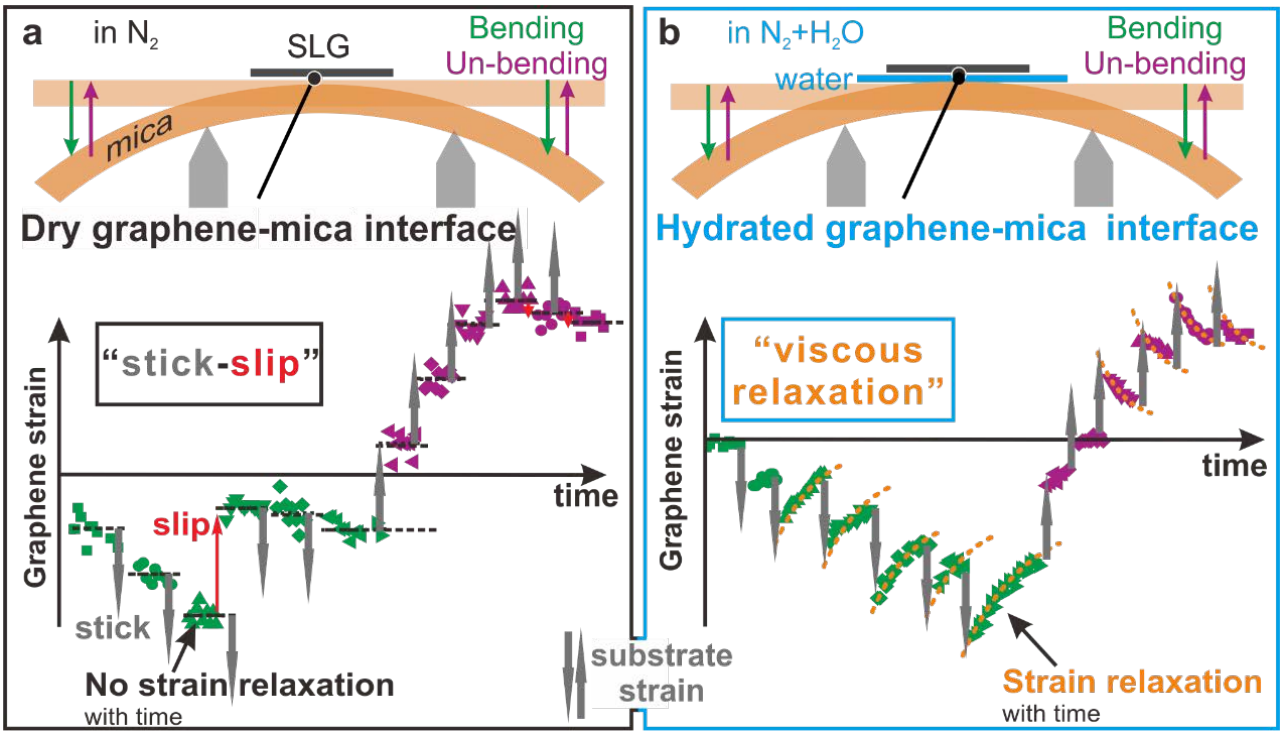
Influence of interface hydration on sliding of graphene and Molybdenum-disulphide single-layers



Strain transfer measurements for both a) dry and b) hydrated graphene-mica interfaces: the surface of the mica substrate was strained by bending the mica slab in steps. Strains in graphene were followed with Raman peak positions. Strain relaxation in graphene changes from stick-slip in dry contact, to viscous when hydrated.

Humidity influences friction in layered materials in peculiar ways. For example, while water improves the lubricating properties of graphite, it deteriorates those of molybdenum disulphide (MoS2). The reasons remain debated, not the least due to the difficulty to experimentally compare dry and hydrated interface frictions. Hu Lin et al. [1] have shown that the hydration of interfaces between a mica substrate and single-layers of graphene and MoS2 with a molecularly thin water layer affects strain transfer from the substrate to the 2D materials. For this, the substrate has been strained and the strain in graphene and MoS2 has been detected by changes in Raman and photoluminescence spectra, respectively. Graphenes on dry mica exhibit "stick-and-slip" strain relaxation with frictional forces per area of up to about 100 kPa. Strains relaxation in hydrated graphenes is viscous with estimated viscous friction coefficients in units of force per unit area and per unit velocity of about 1*1017 Pa·s/ m. In contrast, there is no viscous relaxation in MoS2 regardless of hydration. This work provides a novel approach for better understanding the impact of hydration on friction in layered materials.

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