The long march toward the zero friction

Mengzhou Liao
Department of Control Engineering, Faculty of Electrical Engineering, Czech Technical University in Prague, Technicka 2, 16627 Prague 6, Czech Republic
MengzhouLia@fel.cvut.cz

Abstract (Century Gothic 11)

Friction causes massive energy dissipation and mechanical abrasion between machine parts every year (costing approximately 119 EJ). Understanding the mechanism of the frictional processes and searching for an optimum material combination, ideally providing a near frictionless state, is thus essential. Recent works show that near-zero interface friction can be realized in twisted 2D materials or 2D heterostructures due to their ultra-flat interface PES. However, the origin of friction is complex. Suppressing one primary source will make friction from other mechanisms to the surface. Thus, toward the pure zero friction state will be a long march.

The speaker will report the friction phenomenon of superlubric MoS_2/graphite and MoS_2/h-BN van der Waals heterostructure interfaces in this talk. As shown in Figure 1, instead of reaching a frictionless state with a suppressed interface friction, in those interfaces, mechanisms like the edge pinning effect [1] and the variation of structure potential energy [2] start to dominate the friction processes and provide friction during the sliding and twisting. Those phenomena explain why it is hard to realize low friction on the macro scale. The speaker will further discuss the main challenges and give possible ways toward a pure zero friction state in the talk.

References

[1] Liao, M., Nicolini, P., Du, L., . . . Zhang, G. Nature Material (2022), 21(1), 47-53.
[2] Liao, M., Andrea, S., Du, L., . . . Zhang, G. The twisting dynamic of large lattice mismatch van der Waals heterostructures. Under reviewing.

Figures

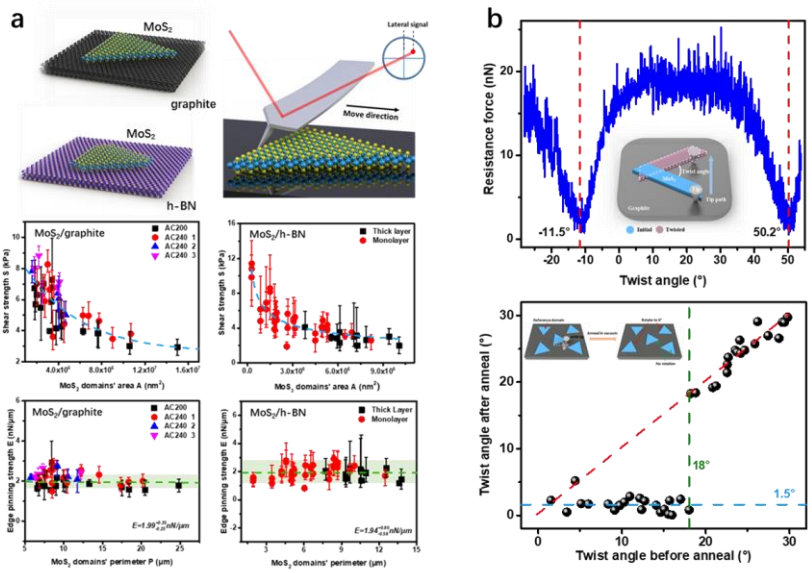

Figure 1: a and b: edge pinging effect (a) and twisting effect (b) of large lattice mismatch heterostructures at translational and rotational motions