Electrostatic Friction of Grain Boundary in MoS_2

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The study of Two-dimensional (2D) semiconducting materials, such as MoS_2, holds great promise for advanced electronic devices, for their unique and promising physical and electrical properties. However, chemical vapor deposition (CVD), which is a mandatory method for the synthesis of 2D materials in large quantities, exhibits lower-than-expected properties owing to numerous defects. Among those defects, grain boundary (GB) is a critical factor that affects the electrical and mechanical properties of synthesized MoS_2. Here I will present our research on the relationship between gate-tunable electrostatic properties and friction of GB in CVD-synthesized MoS_2 films using atomic force microscopy (AFM) [1]. We found that the electrostatic Coulomb interaction between the AFM tip and the carriers of MoS_2 plays a significant role in MoS_2 friction, especially at GB with different local band structures. The study highlights a strong correlation between electrostatic friction and localized band structure in MoS_2 GBs, providing a novel method for identifying and characterizing GBs of polycrystalline 2D materials, which is important for optimizing their properties for advanced electronic devices.

References

[1] Jae Hwan Jeong, Yeonjoon Jung, Jang-Ung Park, and Gwan-Hyoung Lee, Nano Letters, 23.7 (2023) 3085-3089

Figures

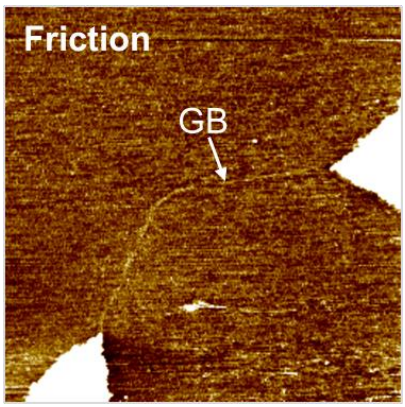

Figure 1: AFM friction image of MoS2 GB area