Frictional Characteristics of Suspended MoS$_2$

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AFM, suspended MoS$_2$, friction

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INTRODUCTION
Molybdenum disulfide (MoS$_2$), a booming layered two-dimensional (2D) nanomaterial, has gain intensive interests for its remarkable physical properties. In this work, the friction characteristics of suspended MoS$_2$ are systematically investigated with atomic force microscopy (AFM). The friction on the suspended MoS$_2$ is much larger than that on the supported MoS$_2$ because of the softening bending rigidity and easier formation of puckering at the AFM tip–MoS$_2$ contact interface, and the difference would increases with the applied load. Similar to the supported MoS$_2$, the friction on the suspended MoS$_2$ also decreases with the increasing layers because of the enhanced bending rigidity. The friction on the suspended MoS$_2$ is relatively insensitive to the shapes of holes below but sensitive to the dimensions. This work can provide beneficial guidance for the diverse design requirements of MoS$_2$-based nanoelectromechanical devices, and is also meaningful in the application of MoS$_2$ as solid lubricants.