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**Charging effect and midgap states at grain boundaries of MoS<sub>2</sub><sup>1</sup>**

XI DONG, CHENHUI YAN, MICHAEL WEINERT, Department of Physics, University of Wisconsin, Milwaukee, LIAN LI, Department of Physics and Astronomy, West Virginia University — Grain boundaries (GBs) are the inevitable extended defects in chemical vapor deposited (CVD) MoS<sub>2</sub> single layer films. Here, we report the direct observation of atomic and electronic structures of GBs in CVD grown MoS<sub>2</sub> on epitaxial graphene/SiC(0001) substrate using scanning tunneling microscopy/spectroscopy. Atomic resolution imaging indicates that GBs are mostly consisted of a linear array of dislocation cores such as 7-5 rings. Tunneling spectroscopy investigations further show the existence of mid-gap states at these dislocation cores, as well as charging effect that shifts both conduction and valence band edges. Our findings provide new insights into the nature of GBs in MoS<sub>2</sub>.

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