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**Direct Visualization of Edge States and Electrical Inhomogeneity in $MoS_2$ Field Effect Transistors** DI WU, LAN LUAN, ZHAODONG CHU, XIAOYU WU, KEJI LAI, Department of Physics, University of Texas at Austin — Ultrathin transition metal dichalcogenides (TMDs) with layer-dependent bandgaps, relatively high carrier mobilities, and valley pseudospins are promising material platforms for novel electronics. It is of great importance to microscopically probe the TMD-based electronic devices for understanding and improving their performances in relation to metal contacts, interfaces, and defects. Here, we report the electrical imaging of the channel conductance of few-layer $MoS_2$ field-effect transistors by microwave impedance microscopy (MIM). A systematic evolution of the local conductance of exfoliated MoS2 back-gated devices was captured during the insulator-to-metal transition induced by electrostatic gating. Interestingly, when the transistors were gradually turned on, the carriers were first accumulated at the edges of MoS2 flakes, as indicated by the higher local conductivity in MIM images. At the same time, we have also observed strong local conductance fluctuation, which are presumably due to the charged impurities in the flakes or defects at the interfaces. The MIM images can thus provide us the microscopic understanding of how the device performance is influenced by the local defects and edge states.

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