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Measurement of bandgap and doping effects in ultrathin MoS2 layers using scanning tunneling spectroscopy.[1] CHIH-PIN LU, GUOHONG LI, IVAN SKACHKO, EVA ANDREI, Department of Physics and Astronomy, Rutgers University, DEPARTMENT OF PHYSICS AND ASTRONOMY, RUTGERS UNIVERSITY TEAM — Molybdenum disulfide MoS_2, a semiconductor in the layered transition-metal dichalcogenide family of materials which is composed of weakly interacting layers held together by van der Waals interactions, offers an attractive possibility as a field effect transistor in low-power switching devices. We studied ultrathin MoS2 samples, ranging from single to several layers in thickness, that were extracted by mechanical exfoliation from the bulk material. Using a device geometry which allows varying the carrier density by gating across a 300nm insulating layer of SiO_2, together with low temperature Scanning Tunneling Microscopy and Spectroscopy, we investigated the bandgap and its dependence on doping and number of layers. For few layer samples we observe a well resolved atomic structure and a band gap of $\sim$ 1.1eV which is a little small than bulk band gap of 1.2eV. In addition we observe that electron doping shifts the Fermi energy into the conduction band. In single layer samples the measured bandgap is about $\sim$ 1.8eV in agreement with photoluminescence measurements and can change by backgate voltage.

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