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SPE-LEEM Studies on the Surface and Electronic Structure of 2-D Transition Metal Dichalcogenides (Part II)[1] WENCAN JIN, PO-CHUN YEH, NADER ZAKI, DATONG ZHANG, Columbia Univ, JERZY SADOWSKI, ABDULLAH AL-MAHBOOB, Brookhaven National Laboratory, AREND VAN DE ZANDE, Energy Frontier Research Center, Columbia Univ, DANIEL CHENET, JERRY DADAP, IRVING HERMAN, Columbia Univ, PETER SUTTER, Brookhaven National Laboratory, JAMES HONE, RICHARD OSGOOD, Columbia Univ — In this work, we studied the surface and electronic structure of monolayer and few-layer exfoliated MoS_2 and WSe_2, as well as chemical-vapor-deposition (CVD) grown MoS_2, using Spectroscopic Photoemission and Low Energy Electron Microscope (SPE-LEEM). LEEM measurements reveal that, unlike exfoliated MoS_2, CVD-grown MoS_2 exhibits grain-boundary alterations due to surface strain. However, LEEM and micro-probe low energy electron diffraction show that the quality of CVD-grown MoS_2 is comparable to that of exfoliated MoS_2. Micrometer-scale angle-resolved photoemission spectroscopy (ARPES) measurement on exfoliated MoS_2 and WSe_2 single-crystals provides direct evidence for the shifting of the valence band maximum from Γ to K, when the layer number is thinned down to one, as predicted by density functional theory. Our measurements of the k-space resolved electronic structure allow for further comparison with other theoretical predictions and with transport measurements.

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