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Band Structure Evolution in Vertically Contacted MoS_2 Probed Using Scanning Tunneling Spectroscopy ALEXANDER KERELSKY, ANKUR NIPANE, DREW EDELBERG, DENNIS WANG, MINGHAO CHENG, ALI DADGAR, Columbia University, HUI GAO, KIBUM KANG, JIWOONG PARK, Cornell University, JAMES TEHERANI, ABHAY PASUPATHY, Columbia University — Achieving high-quality electrical contact between deposited metals and monolayer transition metal dichalcogenides remains a challenging problem. In this work, we probe the factors influencing the contact resistance by using atomic-resolution scanning probe microscopy and spectroscopy at the interface between a contact metal and highly doped monolayer molybdenum disulfide (MoS_2). Using atomically resolved spectroscopy measurements, band structure evolution is mapped across the edge of the contact and into the MoS_2 sheet. The spectroscopy shows the presence of metal induced gap states (MIGS) in the semiconductor with a decay length of a few angstroms from the interface, which is the first experimental observation of MIGS in a two-dimensional semiconductor. We show that in the highly doped limit, the MIGS dominate the electronic properties and hence the contact resistance, as opposed to band bending. Finally, we describe the difference in MIGS between graphite, gold and palladium electrodes on MoS_2.

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