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High Performance Chemical Sensing Using Schottky-Contacted CVD Grown Monolayer MoS2 Transistors LIANG CHEN, BILU LIU, CHONGWU ZHOU, University of Southern California, USC NANOLAB TEAM — Recently emerged two-dimensional (2D) crystals offer unique advantages as potential sensing materials with high sensitivity, owing to their very high surface-to-bulk atom ratios and semiconducting properties. Here, we report the first use of chemical vapor deposition grown monolayer MoS2 as high performance chemical sensors with Schottky contacts. The Schottky-contacted MoS2 transistors show current changes by two to three orders of magnitude upon exposure to NO2 and NH3. The MoS2 sensors show clear detection of NO2 down to 20 ppb and NH3 down to 1 ppm, both of which are the best among various monolayer or few-layer MoS2 and other 2D transition metal dichalcogenides materials based chemical sensors reported so far. We attribute the observed high performance to both well known charger transfer mechanism and more importantly, the Schottky barrier modulation upon analyte molecules adsorption, the latter of which is made possible by the Schottky contacts in our transistors and is not identified previously for MoS2 sensors. This study may open up new ways for 2D semiconductors as sensors and also may benefit the fundamental studies of interfacial phenomena and interactions between various chemical species and monolayer semiconductors.

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