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Electronic Transport and Spatial/Temporal Photocurrent in Monolayer Molybdenum Disulfide Grown by CVD. ZHENGFENG YANG, Univ of Illinois - Urbana, ROBERTO GRASSI, University of Minnesota, MARCUS FREITAG, IBM Thomas J. Watson Research Center, YI-HSIEN LEE, National Tsing Hua University, TONY LOW, University of Minnesota, WENJUAN ZHU, Univ of Illinois - Urbana — We systematically investigate the electronic transport in transistors/Hall-bar devices and spatial/temporal photocurrent in photodetectors based on monolayer MoS_2 grown by CVD. We found that the maximum photocurrent occurs when laser spot is close to the metal/MoS_2 contact and is tunable by the applied drain voltage, which can be explained by the modulation of the local electric field at the Schottky barrier, consistent with predictions from our quantum transport simulation. We observed that the maximum photocurrent at drain contact is much larger than the one at source contact, and the DC currents show rectifying behavior. These phenomena can be explained by the different Schottky barrier heights at the two contacts. By measuring Hall-bar device at various temperatures from 100K to 400K, the extracted barrier height at drain contact is about 50mV larger than the one at source contact, consistent with the photocurrent and DC current observations. Photocurrent was measured at various powers and a photoresponsivity of 3.07 mA/W was extracted at low powers. When the power increases above 20uW, the photocurrent starts to saturate. Temporal response of the photocurrent is also dependent on the laser power. These studies of photocurrents and electronic transport in CVD MoS_2 highlight the importance of the contacts in the electronic/optoelectronic devices and reveal the physical mechanism of the photocurrent/electronic transport in these devices.

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