Parameter Controls for Enhanced Peak-to-Valley Current Ratio in $MoS_2/MoTe_2$ van der Waals Heterostructure

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Abstract

The I_{ds}-V_{ds} properties of a van der Waals cross-junction of a few layers $MoS_2/MoTe_2$ were investigated, and the physical device parameter was altered in order to transform the conduction mechanism of our devices from thermionic to interband tunneling. Lowering the contact resistance between the metal and channel materials, by changing the electrode metals from Au to Pd and Ti, alone did not give rise to the carrier conduction through the hetero-interband tunneling between $MoTe_2$ and MoS_2. In addition to the reduction in contact resistance, the chemical doping of MoS_2 using BV achieves hetero-interband tunneling between $MoTe_2$ and MoS_2, which probably narrows the depletion layer by degenerating MoS_2. The peak-to-valley ratio of the tunneling current of the BV-doped heterostructure of $MoS_2/MoTe_2$ is about 4.8, which is comparable to that of the commercially available Si tunneling diode.

References

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Figures

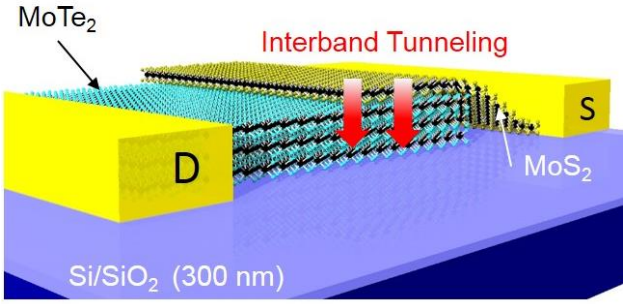

Figure 1: 3D-schematic image of $MoS_2/MoTe_2$ heterostructure fabricated on Si/SiO_2 (300 nm) with Interband Tunneling current.

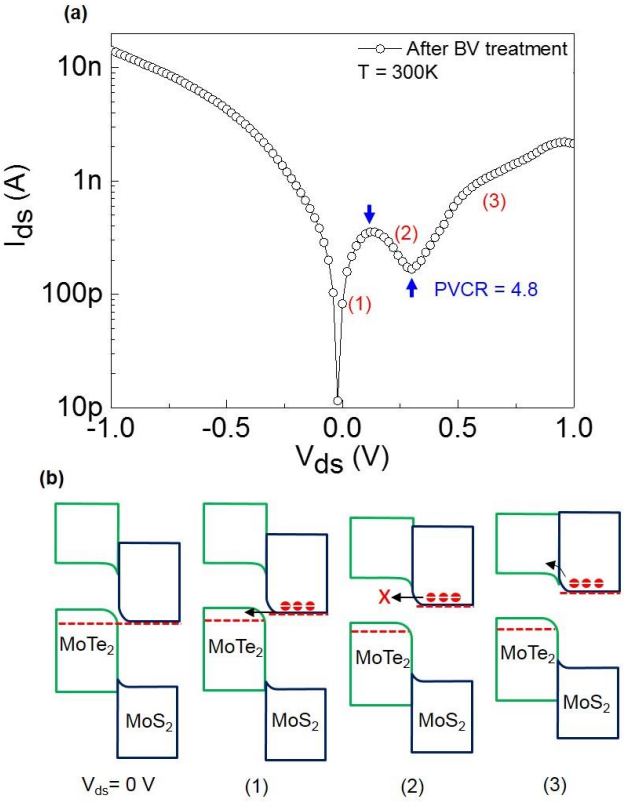

Figure 2: (a) I_{ds}-V_{ds} of $MoS_2/MoTe_2$ hetero-structure. The presence of Negative Differential Resistance (NDR) is attributed to the Interband tunnelling phenomenon. (b) Schematics of the band modulation of BV-doped $MoS_2/MoTe_2$ heterostructure as a function of V_{ds}.