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Dual-Gated $MoTe_2/MoS_2$ van der Waals Heterojunction p-n Diode[1] AMRITESH RAI, HEMA C. P. MOVVA, SANGWOO KANG, STEFANO LARENTIS, ANUPAM ROY, EMANUEL TUTUC, SANJAY K. BANERJEE, Univ of Texas, Austin — 2D materials are promising for future electronic and optoelectronic applications. In this regard, it is important to realize p-n diodes, the most fundamental building block of all modern semiconductor devices, based on these 2D materials. While it is challenging to achieve homojunction diodes in 2D semiconductors due to lack of reliable selective doping techniques, it is relatively easier to achieve diode-like behavior in van der Waals (vdW) heterostructures comprising different 2D semiconductors. Here, we demonstrate dual-gated vdW heterojunction p-n diodes based on p-type $MoTe_2$ and n-type MoS_2, with hBN as the top and bottom gate dielectric. The heterostructure stack is assembled using a polymer-based 'dry-transfer' technique. Pt contact is used for hole injection in $MoTe_2$, whereas Ag is used for electron injection in MoS_2. The dual-gates allow for independent electrostatic tuning of the carriers in $MoTe_2$ and MoS_2. Room temperature interlayer current-voltage characteristics reveal a strong gate-tunable rectification behavior. At low temperatures, the diode turn-on voltage increases, whereas the reverse saturation current decreases, in accordance with conventional p-n diode behavior.

[1]Dual-Gated MoTe2/MoS2 van der Waals Heterojunction p-n Diode

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