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Ultrasensitive Intrinsic Multilayer MoS_2 Photodetector using 1D Electrical Contact

In past years, 2D crystals have been studied intensively for use in future nanodevices. Recently, emerging 2D materials are considered one of the most important nanomaterials for building blocks of nanoscale photodetector fabrication. MoS_2, as a 2D material, has S-Mo-S units structures bonded by van der Waals forces.[1] Its bandgap ranges from 1.2 to 1.8 eV as the thickness decreases from bulk to monolayer. The optoelectronic properties of MoS_2 field effect transistor have attracted intensive attention, whose photoresponsivity ranges from 0.05 to 342.6 $A*W^{-1}$.[2-3] Ultimate thin vertical p-n diode using MoS_2 has also been demonstrated, which is available for photodetection. [4] However, 2D materials electrical behavior is remarkably influenced by metallic contact property. Here, we applied 1D electrical contact to intrinsic multilayer MoS_2 to form Fermi level pinning free contact, restudying the photoelectric property of multilayer MoS_2 with hole carriers. The photoresponsivity of intrinsic 1D contact MoS_2 FET reaches at 1238 $A*W^{-1}$ (hole) at 550 nm, as shown in Figure 1, even better than monolayer MoS_2 photo responsivity of 880 $A*W^{-1}$ (electron) at 561 nm.[5] The result poses important potential for high performance future photonic applications including MoS_2-based integrated optoelectronic circuits, light sensing and emission.

References

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Figures

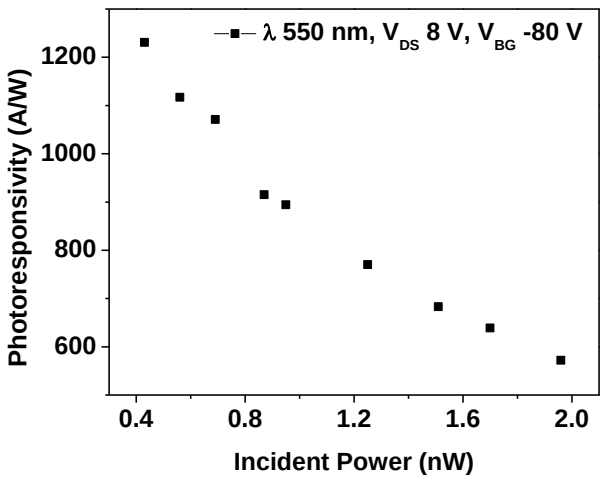

Figure 1: 1D Contact MoS_2 transistor photoresponsivity as a function of incident power.

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