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Highly Sensitive, Large-Area MoS_2 Photodetectors with Graphene Contacts

Monolayer transition metal dichalcogenides (TMDs) have a direct bandgap and extraordinary light absorption [1-3], making them ideal candidates for atomically-thin optoelectronics. Although there have been previous reports of sensitive photodetectors based on monolayer MoS_2 [2, 4], they were mainly based on material obtained by exfoliation, not suitable for mass production, and using thicker metals such as Au for source and drain electrodes, not ideal for flexible electronics. Here we show that large-area MoS_2 transistors with graphene electrodes, fabricated using CVD-grown material, yield performance that matches or exceeds the performance of photodetectors based on exfoliated materials, with record shot-noise-limited detectivities of 8.7×10^{14} Jones in ambient conditions and even higher when encapsulated. This figure of merit is at least one order of magnitude higher than the values reported for exfoliated devices [4]. The devices with graphene electrodes have a tunable band alignment and are suitable for scalable ultra-thin flexible optoelectronics [5].

References

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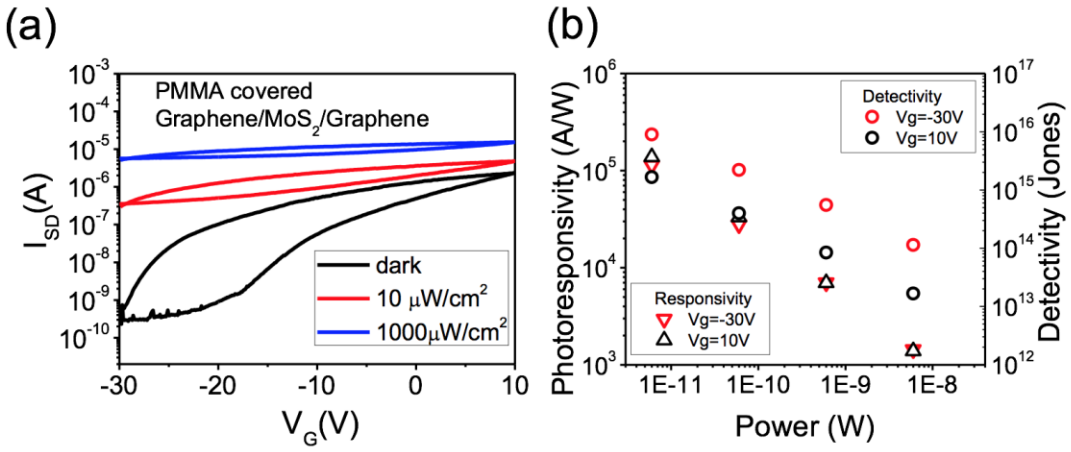
Figures



Photoresponse of a PMMA-covered device (a) and power dependence of its photoresponsivity and detectivity (b).