Graphene/MoS_2 Flexible Photo-detector

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Abstract

We present a large area, flexible photodetector for visible wavelengths fabricated by stacking centimetre-scale chemical vapor deposited (CVD) graphene and CVD MoS_2, both wet transferred onto a flexible polyethylene terephthalate (PET) substrate (fig. 1). In this configuration, MoS_2 acts as an absorbing material for visible wavelengths, while graphene is primarily used as a conductive channel for photocurrent flow. When electron-hole pairs are generated in MoS_2 upon illumination of the stack, MoS_2 donates electrons to the p-doped graphene channel [1], resulting in a decrease of the total source-drain current. In this configuration, the device responsivity can be enhanced either by promoting the injection process from MoS_2 to graphene through side-gating using a polymer electrolyte (fig. 2), a technique that is suitable for a flexible platform [2,3], or by increasing the photoconductive gain in the graphene channel by applying larger source-drain voltage. The photodetector has an internal responsivity as high as ~30A/W at 642nm. This is at least two orders of magnitude higher than previously reported values for bulk-semiconductor flexible membranes [4,5] and for other flexible photodetectors based on a combination of graphene and MoS_2 [6,7,8]. The photocurrent is stable at different bending angles, with variations less than 15% for radiuses of curvature down to 6cm.

References

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Figures

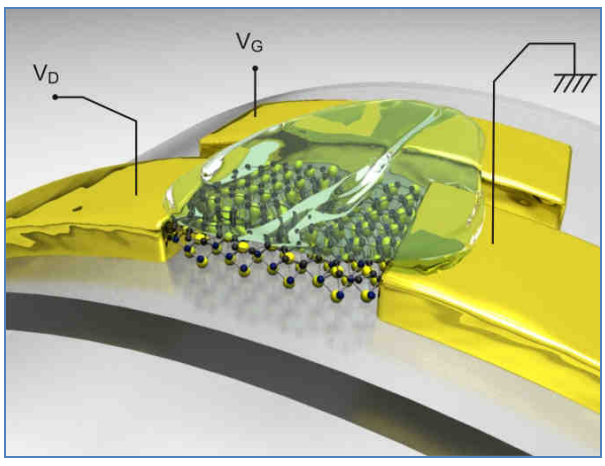

Fig 1. Sketch of the flexible photodetector

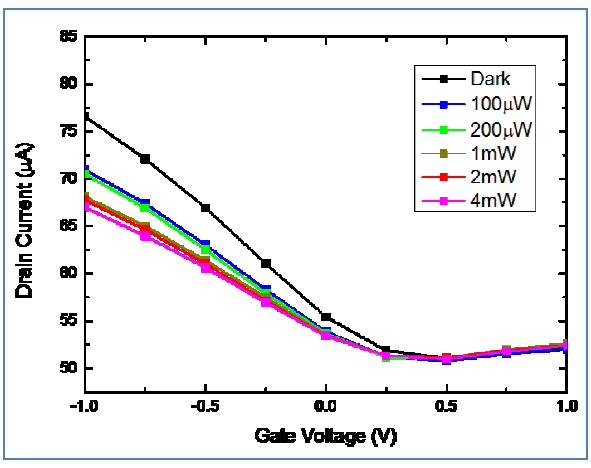

Fig 2. I – V trans-characteristics of the device at different optical powers