Printed MoS_2/Graphene Photodetector

L. Lombardi, F.Torrisi, F.Tomarchio, A. C. Ferrari

Cambridge Graphene Centre, 9 JJ Thomson Avenue, Cambridge CB3 0FA, UK
ll455@cam.ac.uk

The electrical and optical properties of graphene and other 2d crystals are ideal for flexible, transparent, conductive electrodes [1], thin film transistors (TFTs) [2], photodetectors (PDs) [3], flexible batteries and smart textiles [2]. Liquid phase exfoliation (LPE) allows one to produce printable inks [4, 5] based on graphene and 2d crystals. LPE can be used to control concentration and morphology of 2d flakes at room temperature in a wide range of solvents [6, 7]. Inkjet-printed graphene/MoS_2 PDs were reported with an external responsivity of few tens of nA/W at drain voltage of 40V [8]. Here we report a graphene/MoS_2 PD, Fig.1 (a) fabricated by inkjet-printing on polyethylene terephthalate (PET) a 40μm MoS_2 channel and then contacted by two inkjet printed graphene electrodes. In this configuration, graphene acts as conductive electrode, while MoS_2 is the active layer where light absorption takes place. The device has an external responsivity of 960 nA/W, measured at 514nm and drain voltage of 30V, Fig.1 (b). This is 2 orders of magnitude higher than the previous reports [8]. Our device has an internal responsivity up to 0.2mA/W. This result demonstrates the viability of inkjet printed 2d-material inks for PDs, suitable for flexible, printed optoelectronics.

[1] F. Bonaccorso et al., Nat. Photon., **4** (2010) 611.
[2] A.C. Ferrari et al., Nanoscale, DOI: 10.1039/c4nr01600a, (2014).
[3] F.H.L. Koppens et al., Nat. Nanotec.,**10** (2014) 780.
[4] F. Torrisi et al., ACS Nano, **6** (2012) 4.
[5] F. Torrisi et al., Nat. Nanotec., **10** (2014) 738.
[6] J.N. Coleman et al., Science, **331** (2011) 568.
[7] Y. Hernandez et al., Nat. Nanotec., **3** (2008) 563.
[8] J. Finn et al., J. Mater. Chem. C, **2** (2014) 925.

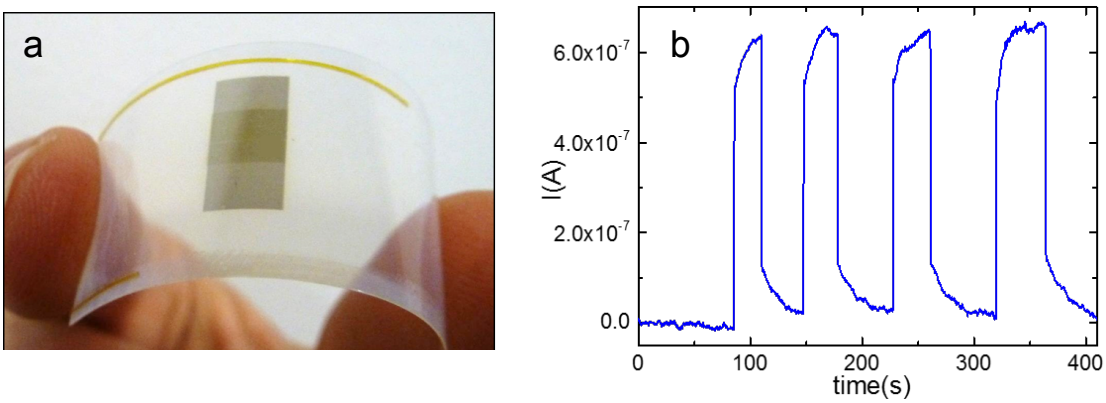

Figure 1 a) Printed graphene/MoS_2 photodetector. b) Time domain photoresponse of the graphene/MoS_2 photodetector measured at 514nm and at +30V bias voltage.