# MSM photodetector based on gold decorated graphene ink

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Graphene is a single atom monolayer of carbon atoms, has many applications in optics and optoelectronics [1] competing important applications in nanoelectronics [2]. Several methods are used to fabricate graphene: mechanical exfoliation, epitaxial growth and advanced chemical vapor deposition (CVD) techniques [3]. Graphene monolayer flakes, obtained via mechanical exfoliation and deposited over interdigitated (IDT) electrodes, were recently used for the photodetection at 1.55 µm with a responsivity of 6.1 mA/W [4].

Lately, graphene inks are a promising alternative for graphene device implementation especially in optoelectronic domain (see Ref. 5 and the references herein).

In this communication, we have used a combination of top-down and bottom-up approaches to fabricate a graphene photodetector. Our device consists of a MSM IDT bimetallic electrodes (Au/Pt) array (see Figure 1a) deposited on high resistivity (HR) Si wafer over which gold decorated graphene dispersion has been casted.

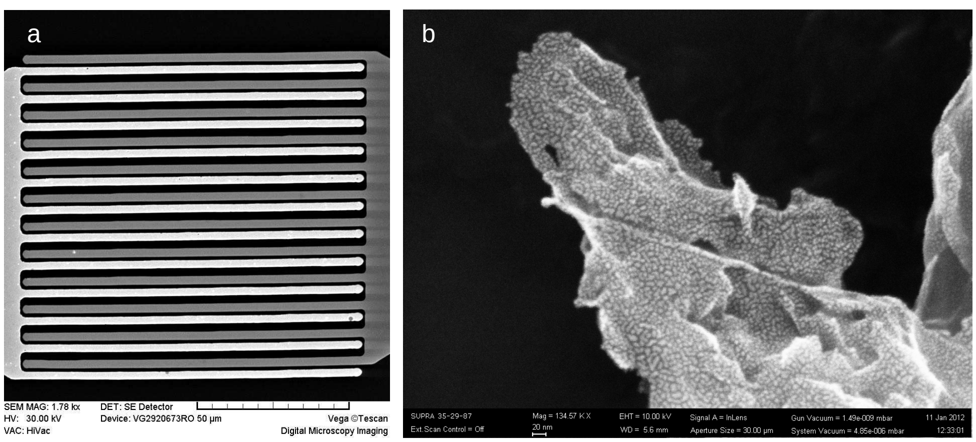


Figure 1: Interdigitated (IDT) bimetallic (Au/Pt) electrodes (a); SEM micrograph of gold decorated graphene nanoplatelets

The Au-Pt IDT array was manufactured on HR Si substrate using standard metallization techniques and photolithography. Pristine graphene nanoplatelets (PureSheets QUATTRO, NanoIntegris, USA) were purified by removing the surfactant and re-suspension in distilled water. A certain aliquots of graphene dispersion was allowed to dry onto glass slides and further used in the metallization process. After gold has been deposited using sputtering procedure, scanning electron microscopy investigations (SEM) revealed nanosized gold platelets (Figure 1b).

The I-V measurements were made with the semiconductor characterization system Keithley 4200, connected to a dark Faraday cage and the light was incident directly on the device. Due to the relatively high mobility of the photogenerated electrons and holes and the small gaps between IDT fingers (1 µm), a significant photoresponse is achieved before carrier recombination. The *I-V* characteristics were first recorded at dark and for illumination with a halogen lamp, which generates a tunable power with a maximum of 150 W in the visible spectrum. Also, an IR source consisting of a tungsten halogen lamp with a power of 0.5 mW, which extend the spectral domain from 1500 nm to 2500 nm was used. The resulted I-V responses are depicted in Figure 2.

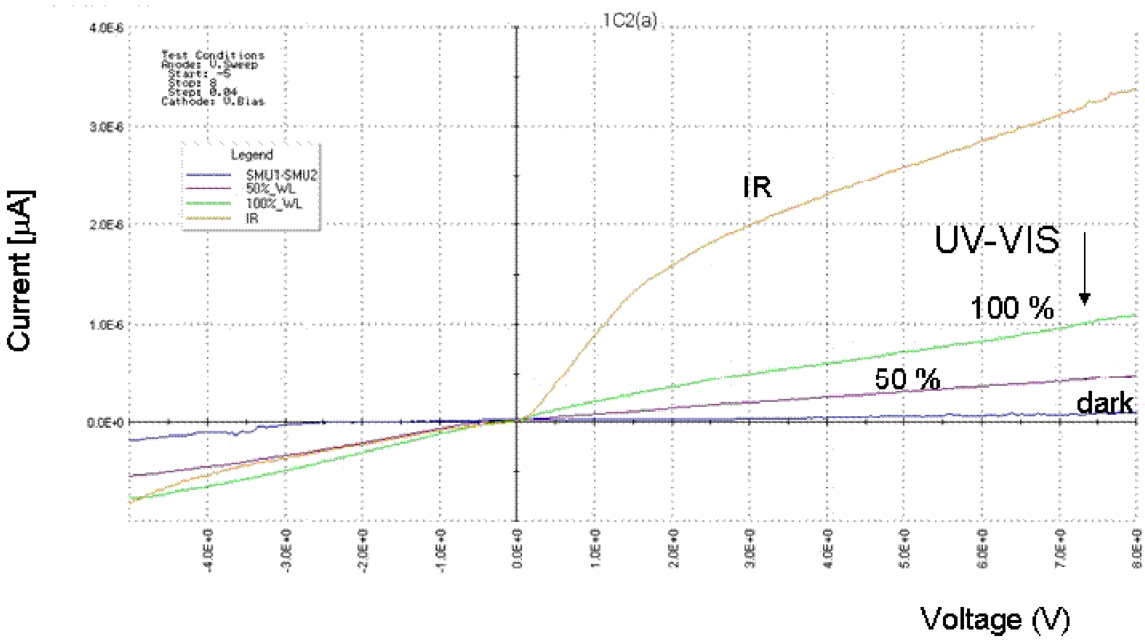


Fig. 2 The I-V response of graphene ink photodetector under various illuminatons.

From the above figure we can see that in the UV-VIS spectral region when 100% of the power lamp is illuminating the photodetector, the current is increasing more than 10 times (from ~90 nA up to ~1.2 μA at V=8 V). In the case of IR, the current is increasing about 40 times when compared to dark current. Further tests are currently under investigation.

*Authors acknowledge that this work was supported by a grant of Romanian National Authority for Scientific Research, CNCS-UEFISCDI, project number PN-II-ID-PCE-2011-3-0071*

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