Fast response, high responsivity and broadband Graphene/n-Si photodetector

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To surmount the limiting low efficiency in near ultraviolet and infrared regions of Si photodetectors (PDs) [1], and to improve its temporal response, we present a detector based on Graphene/n-Si hetero-junction [2,3]. In this device graphene takes on a multiple role: semi-transparent light window, Schottky junction constituent, photo charges generator and collector. The designed PD multifinger geometry allows to obtain the typical I-V characteristics of a three terminals device (Fig.1) which can be used in photovoltaic (PV) and in photoconductive (PC) mode. The obtained PDs which operate at room temperature, are sensitive in the spectral region from the UV (240 nm) to the IR (2000 nm). Moreover, they have high responsivity up to 10^7 A/W, a rise time of a few ns, an external quantum efficiency more than 300%, and a linear response for different light sources. The obtained results are among the highest respect others graphene and carbon nanostructures-based devices thanks to the high quality of the graphene deposited on a large area of 8 mm^2 supported by our device design [4,5] of the interdigitated electrodes, preserving the excellent properties of graphene when switching from a nanoscale to the macroscopic dimensions of commonly used devices.

REFERENCES

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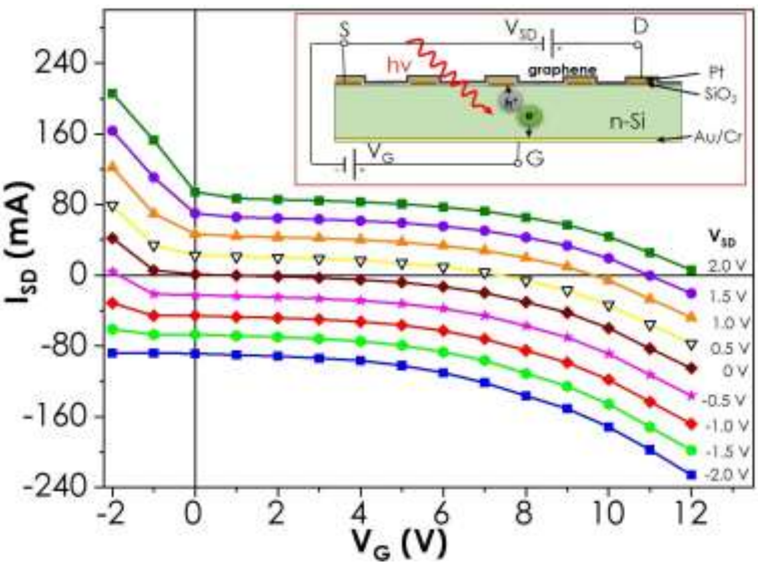
FIGURES



graphene/n-Si Photodetector

spectral range: 240 – 2000 nm

Responsivity: 10^7 A/W

Rise time: 1 ns

Active area: 8 mm^2

Figure 1: Source-drain current I_{SD} vs. gate voltage V_G acquired in dark conditions for different values of V_{SD}. Inset: device schematic under illumination in PC mode