(Two page abstract format: including figures and references. Please follow the model below.)

Transparent flexible photosensors based on graphene-metal hybrid structures

Ya-Ping Hsieh*, Mario Hofmann and Chih-Han Yen

Graduate of Institute of Opto-Mechatronics National Chung Cheng University, Chiayi, Taiwan, ROC
yphsieh@ccu.edu.tw

Abstract (Arial 10)

Graphene, a single atomic layer of carbon, has potential as a transparent and flexible optoelectronic sensor due to its high carrier mobility and low carrier concentration. Because of its semi-metallic band structure, graphene's adsorption constant covers over a wide range of illumination wavelength, ranging from infrared to visible light[1]. Thus, applications in broadband light detection in communication and sensing is envisioned[2]. However, graphene's optoelectronic response is limited. The main challenge, however, arise from graphene's small interaction with light. Firstly, due to its high transparency, graphene only interacts with 2.3% of the incident photons. Additionally, these photons only generate electrons with a 6–16% internal quantum efficiency [1]. These two factors result in a very small photoresponse of pristine graphene[1]. Improving the absorption and conversion of light on graphene are therefore of great importance for the application of this material in photosensors.

Current approaches include the use of functionalized graphene oxide and photosensitizers in contact with grpahene[3-5]. These strategies have been shown to result in higher photocurrent gain but are hampered by a slow current response and exhibit a decreased detection bandwidth.

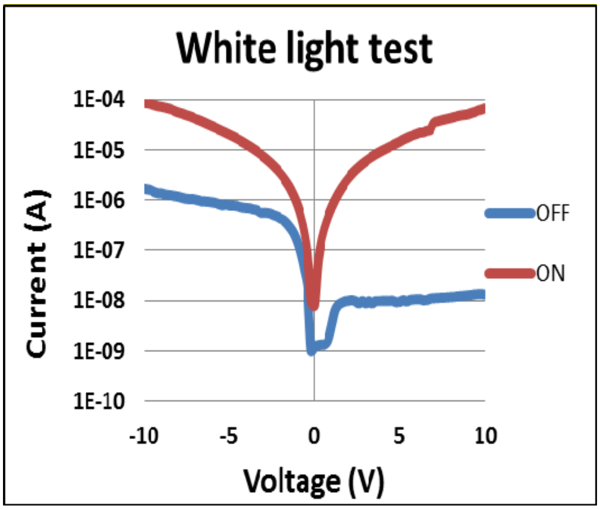
In this work, we introduce a novel, simple approach to produce CVD graphene-metal hybrid structures which could be transparent and flexible. Due to a new sensing mechanism, photocurrent response of 100x~10000x can be observed as shown in Fig. 1(a), which represents a significant increase over existing graphene based sensors. The response time constant is significantly lower than previously reports for metal decorated graphene as shown in Fig 1(b).

Based on the presented detailed study of the mechanism responsible for this enhanced performance, we suggest novel applications that make the novel graphene-metal hybrid structures promising for optoelectronic products.

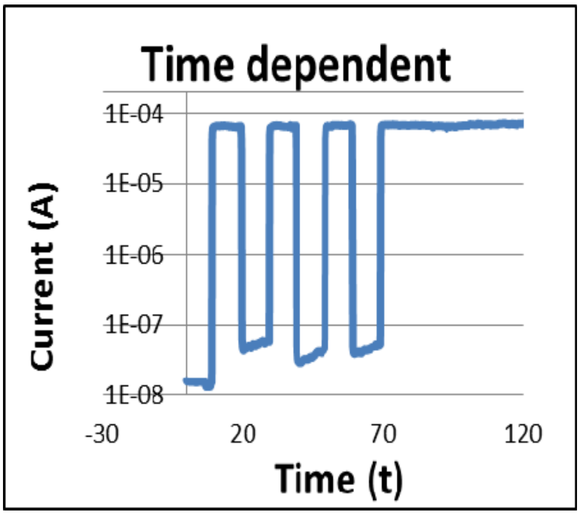
References

[1] Mueller T., F.N.A. Xia, et al., Nat Photonics, **4**(2010) 297.
[2] Xia F., T. Mueller, et al., Nature nanotechnology, **4**(2009)839.
[3] Konstantatos G., M. Badioli, et al., Nature nanotechnology, **7**(2012)363.
[4] Zhang D., L. Gan, et al., Adv Mater,**24** (2012)2715.
[5] Chang-Jian S.K., J.R. Ho, et al., Aip Advances, **2**(2012)022104.

Figures



(a)



(b)

Figure 1. The response and react time are great the normal devices (a)About two to four order photo-response under 5mW of white light (b) the time photoresponse shows the sharp current amplitude representing a fast response.