Gate-tunable Polarization Effect on Photocurrent at Graphene-Metal Interfaces

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Abstract

Graphene holds the potential to be a fast and efficient light-to-current converter thanks to its high carrier mobility, its strong carrier-carrier interaction [1] and the long lifetime of its hot carriers [2]. Although it has been clearly shown that hot carriers dominate the photoresponse in a graphene p-n junction [2], the photocurrent (PC) generation mechanism at graphene-metal (GM) interfaces is still debated. In particular, the observation of polarization dependent photocurrent at GM junctions has been interpreted as the result of photovoltaic photocurrent [3].

Here we study the effect of light polarization on the photocurrent at the GM interface and away from it. Several field-effect phototransistors made of mechanically exfoliated single- and bilayer were investigated under vacuum by scanning photocurrent microscopy. Spatial mapping of the photocurrent (Figure 1a) reveals strong light polarization dependence (~30% contrast) of the photocurrent at GM interfaces, with a maximum when the polarization is perpendicular to the interface (Figure 1b). Photocurrent measured away from the contact shows no polarization dependence, thus indicating the role of the metal contact. Interestingly, we find that the polarization contrast and even the photocurrent sign depend on the backgate voltage controlling the Fermi energy (Figure 2). These non-trivial effects provide new insight into photocurrent generation mechanism at GM junctions.

References

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