Photovoltage Enhancement in Twisted-Bilayer Graphene Using Surface Plasmon Resonance

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Graphene, which has been seen as hopeful fundamental element for the future electronics and optoelectronics, can be a potential candidate for traditional III-V-based active material in field of photodetection because of its extraordinary advantages. However, the low external quantum efficiency may be a fatal defect even though the 2.3% optical absorption is really strong in atomic level. Here, based on surface plasmon resonance technique (SPR) and traditional Kretschmann configuration, we couple different graphene samples with two 50nm thick gold plasmonic films to form typical metal-graphene-metal (MGM) photodetector. Scanning photovoltage measurements show that an approximate 700% enhanced photovoltage (compared with traditional normal-incidence type) with obvirous antisymmetric and polarization-dependent properties in twisted-bilayer graphene photodetector (TBGP) at a certain incident angle can be obtained. Furthermore, the photoevoltage is also found to enhance at a near-liner trend with the increase of graphene layers, which imply the future photoresponse will enhanced significantly with graphene layer increasing designedly. Our work paves the way for antisymmetric, polarization-dependent and enhanced photodetectors combining SPR and graphene heterostructures.

References

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Figures

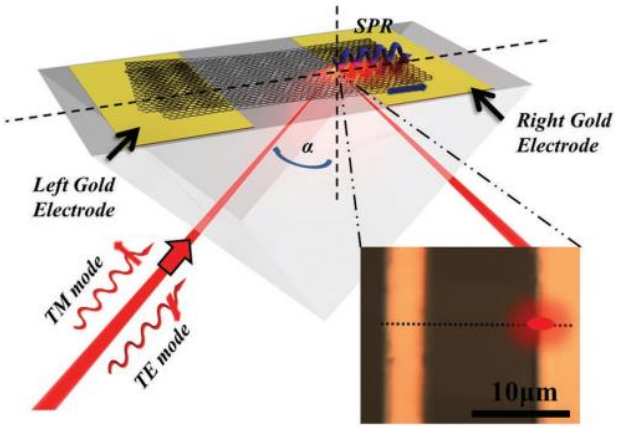

Figure 1: Schematic of photovoltage measurement setup and top view photograph of MGM (inset).

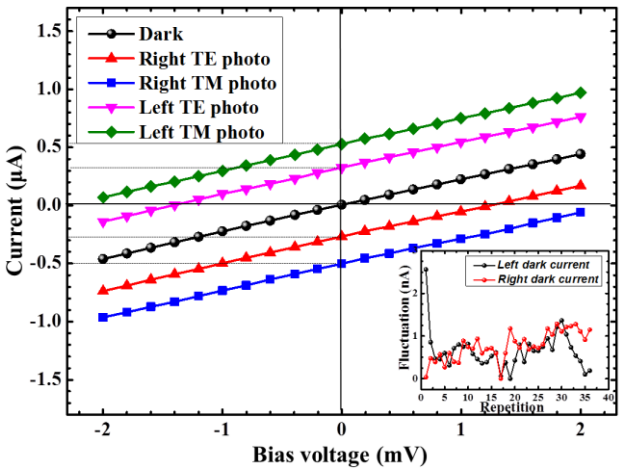

Figure 2: Current curves as a function of bias voltage of 10.0° TBG with and without 633 nm light excitation at the TM and TE modes. Inset image is the dark current experiments of TBG