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Enhanced Photodetection with Hot Electrons in Graphene-mediated Plasmonic Nanostructure

Jeong Hyeon Kim, Jong-Souk Yeo

School of Integrated Technology, Yonsei University, Incheon, Korea

Graphene has received attention with its high electron mobility and visual transparency as a promising material for optoelectronic and photonic applications. Combination of graphene and conducting nanostructures i.e. plasmonic structures has recently been researched for enhancing light-matter interaction and overcoming diffraction limit of light. Here we show enhanced photodetection of incoherent visible light with graphene-mediated plasmonics. Gold nanoparticles fabricated by focused ion beam was used as an active element of photodetection and graphene was utilized as an interfacing material between nanostructures and electrodes. Hot electrons generated upon plasmon decay within nanoparticles pass over the potential barrier between nanostructure and graphene and give rise to a photocurrent with built-in electric field. We report 76.7% enhancement of photocurrent under resonant irradiation of fiber-coupled halogen lamp compared to the case without light illumination. We showed wavelength-dependent current response arisen from plasmonic nanostructure, providing a good agreement with theoretical calculation.

Keywords: plasmonics, graphene, hot electrons, photo-detection, photocurrent, gold nanoparticle

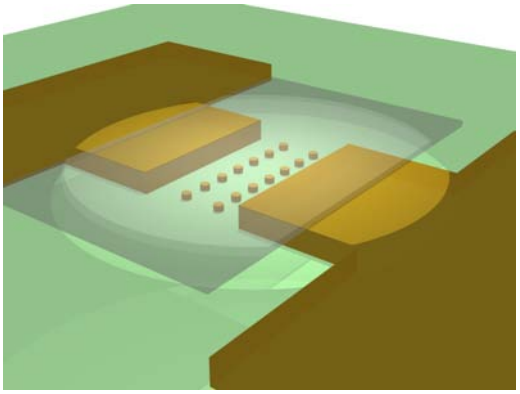

Fig. 1

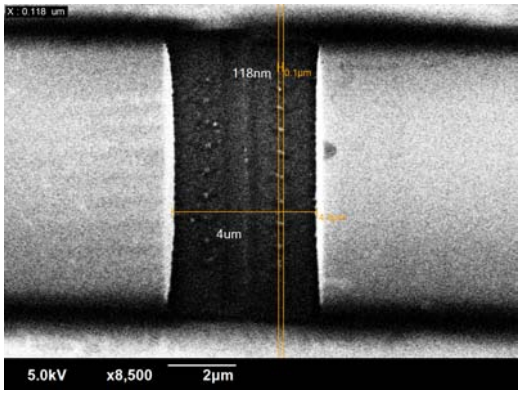

Fig. 2

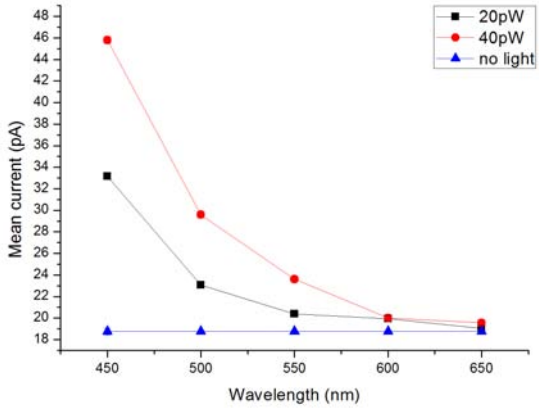

Fig. 3