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高光応答性を有するグラフェン・Si ショットキー接合の作製

Fabrication of high photoresponsive graphene-Si Schottky junction

名工大工　○カリタ　ゴラップ、モハメド　アイハン、種村 眞幸

Nagoya Inst. Technol.　°G. Kalita, M. E. Ayahn, M. Tanemura

E-mail: kalita.golap@nitech.ac.jp

Combinations of graphene based materials with other conventional semiconductors are of great interest for solar cells, photodiode and photodetector applications. Here, we demonstrate the fabrication of a Schottky junction with directly grown- and transferred chemical vapor deposited (CVD)-graphene on Si. Fabricated Schottky junction with transfer-free graphene and n-Si showed a potential barrier of 0.44 eV and rectification diode characteristic. A photovoltaic action was observed in the fabricated device with illumination of simulated solar radiation. Similarly, Schottky junction device was fabricated by transferring CVD graphene on Si substrate (figure 1). In this approach, we grew graphene on Ag substrate and dissolved the base Ag in a diluted HNO_3 solution to create silver nanoparticles (Ag-NPs) on the graphene. Significant photoresponse was observed with illumination of 3.6, 5.1 and 2.1 mW/cm^2 of near-infrared (1000 nm), visible (550 nm) and near ultraviolet (350 nm) light, respectively. The graphene-Si Schottky junction showed photoresponse of 122, 98 and 78 mAW^{-1} at 550, 350 and 1000 nm, respectively. The strong photoresponce was attributed to light interaction with the plasmonic Ag-NPs and effective graphene-Si Schottky junction. Our finding shows that introducing plasmonic nanoparticles photoresponsivity of graphene-Si Schottky junction can be enhanced for solar cell and photodetector applications.

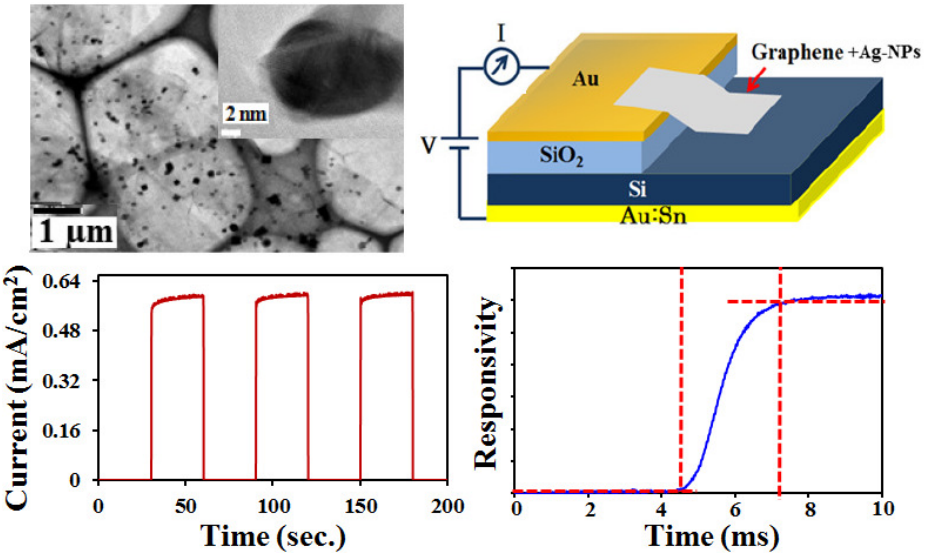

Figure 1 (a) TEM image of Ag-NPs decorated graphene, (b) schematic of graphene-Si Schottky junction, (c) Time-dependent photocurrent and (d) transient response-time with illumination at 550 nm wavelength.