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Graphene/black phosphorus heterostructured photodetector

Jiao Xu[a], Young Jae Song[a], Jin-Hong Park[b] and Sungjoo Lee[a, b,*]

[a]Sungkyunkwan University Advanced Institute of Nanotechnology (SAINT), Sungkyunklwan University (SKKU), Suwon, 440-746, Korea.

[b]School of Electronic and Electrical Engineering, Sungkyunkwan University (SKKU), Suwon 440-746, Korea.

Abstract

Graphene photodetectors exhibit a low photoresponsivity due to their weak light absorbance. In this study, we fabricated a graphene/black phosphorus (BP) heterostructure, in which the multilayer BP flake with a ~0.3 eV direct band gap functions as an enhanced light-absorption material. Further, the photoexcited electrons are trapped in the trap states of the BP, which creates a photogating effect and causes holes to flow into the graphene layer driven by the built-in potential between BP and graphene. The photocarrier lifetime is therefore prolonged by trapping, and as a result of the high carrier mobility of graphene, the holes that transfer into the graphene channel can travel through the circuit before they recombine with trapped electrons. These combined effects result in a high photoresponsivity: 55.75 A/W at λ = 655 nm, 1.82 A/W at λ = 785 nm, and 0.66 A/W at λ = 980 nm.

Keywords: graphene, black phosphorus, photodetector

*Corresponding author.
E-mail address: leesj@skku.edu