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Title of the Presentation: Gate-Tunable Photodetector and High-Mobility Ambipolar Transistor

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Short Biography:

Gwangtaek Oh received his Ph.D. in physics from Konkuk University. He is Post-Doctoral Fellowship in Konkuk University. His thesis is “Study on physical properties of graphene-based ambipolar barristor device”. He has been focused on analysis of electrical and optical properties of graphene-based two-dimensional heterostructure.

Abstract:

Next-generation electronic and optoelectronic devices require a high-quality channel layer. Graphene is a good candidate owing to its high carrier mobility and unique ambipolar transport characteristics. However, the on/off ratio and photoresponsivity of graphene are typically low. Transition metal dichalcogenides (e.g. $MoSe_2$) are semiconductors with high photoresponsivity but lower mobility than graphene. Here we propose a graphene/MoSe2 barristor with a high-k ion-gel gate dielectric. It shows the highest carrier mobility (~247 cm2/V·s) among reported MoSe2 devices, high on/off ratio (3.3×10^4), and ambipolar behavior that is controlled by an external bias. The barristor exhibits very high external quantum efficiency (EQE, 66.3%) and photoresponsivity (285.0 mA/W). We demonstrate that an electric field applied to the gate electrode can significantly modulate the photocurrent of the barristor resulting in high gate tuning ratio (1.50 μA/V). Therefore, this barristor shows potential for use as an ambipolar transistor with high mobility and on/off ratio and a gate-tunable photodetector with high EQE and responsivity.

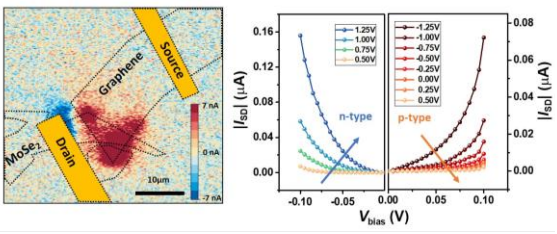

Fig. 1. Scanning photocurrent microscopy image and $|I_{SD}|$–V_{bias} curves of graphene/$MoSe_2$ barristor device.