Ambipolar Field-effect Transistors of Graphene / WSe_2 Heterostructures

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As reported in many studies, graphene and WSe_2, one of the transition metal dichalcogenides (TMDs), shows high carrier mobility and high on/off current ratio, respectively. As both materials have ambipolar property, those are applied to electronics and optoelectronics.

Recent studies have succeeded in fabricating flexible devices based on the junction of graphene and pentacene, which show ambipolar characteristics and high on/off current ratio [1]. In addition, it is reported that the MoS_2/WSe_2 heterojunction device has high photoresponsivity and is highly applicable to solar cells [2].

In this study, we fabricated heterojunction device of graphene and WSe_2 in order to enhance electrical characteristics. We fabricated the junction device using chemical vapor deposition (CVD)-grown graphene and mechanically exfoliated WSe_2. The CVD graphene grown on Cu foil was transferred to a SiO_2 substrate using Poly vinyl alcohol - Polydimethylsiloxane (PVA-PDMS) method. The few layer WSe_2 is transferred using dry transfer onto the graphene on SiO_2 substrate. The junction device showed ambipolar property, high carrier mobility and higher on/off ratio than pure graphene device. Therefore, the graphene/WSe_2 junction offers a promising ambipolar transistor, utilizing both electrons and holes as carriers, in next-generation circuits.

References

[1] Gwangtaek Oh *et al.*, Graphene/Pentacene Barristor with Ion-Gel Gate Dielectric: Flexible Ambipolar Transistor with High Mobility and On/Off Ratio, ACS Nano, (2015) 7515-7522

[2] Amirhasan Nourbakhsh *et al.*, Transport properties of a MoS_2/WSe_2 Heterojunction Transistor and Its Potential for Application, Nano Letters, 16, (2016), 1359-1366

Figures

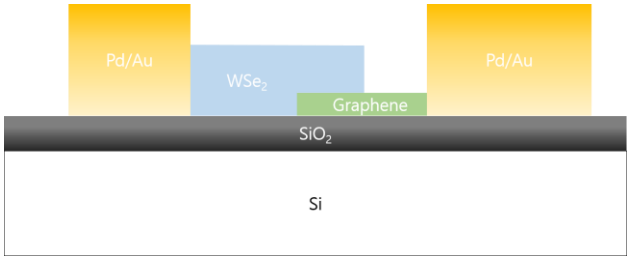

Figure 1 The schematic of graphene/WSe_2 on SiO_2 substrate

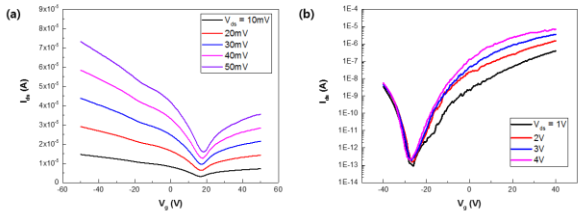

Figure 2 The I-V characteristics of (a)graphene and (b)WSe_2