Ambipolar Field-effect Transistors of Graphene / WSe₂ Heterostructures

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As reported in many studies, graphene and WSe₂, 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 MoS₂/WSe₂ heterojunction device has high photoresponsivity and is highly applicable to solar cells [2].

In this study, we fabricated heterojunction device of graphene and WSe₂ in order to enhance electrical characteristics. We fabricated the junction device using chemical vapor deposition (CVD)-grown graphene and mechanically exfoliated WSe₂. The CVD graphene grown on Cu foil was transferred to a SiO₂ substrate using Poly vinyl alcohol - Polydimethylsiloxane (PVA-PDMS) method. The few layer WSe₂ was transferred using dry transfer onto the graphene on SiO₂ substrate. The junction device showed ambipolar property, high carrier mobility and higher on/off ratio than pure graphene device. Therefore, the graphene/WSe₂ junction offers a promising ambipolar transistor, utilizing both electrons and holes as carriers, in next-generation circuits.

References

Figures

Figure 1 The schematic of graphene/WSe₂ on SiO₂ substrate

Figure 2 The I-V characteristics of (a) graphene and (b) WSe₂