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The study on electrical properties of black phosphorus

Black phosphorus is considered to be a promising candidate for next-generation 2-dimensional electrical devices. Graphene, an ultrathin layered two dimensional material, has been tried as a channel because of its high electrical properties and potential applications in electronic devices. However, its zero band gap has limited application for electrical devices with high on/off ratio. Bulk black phosphorus has been regarded as a p-type semiconducting material with a band gap of ~0.3 eV and high carrier mobility of ~1000 $cm^2/V{\cdot}s$ at room temperature. Additionally, an exfoliated few-layer black phosphorus with direct band gap of ~1.2 eV exhibits mobility of 200−1000 $cm^2/V{\cdot}s$ and on/off ratio of 10^4–10^5 in a field effect transistor. We have fabricated field effect transistor device composed of a few-layer black phosphorus channel for exploiting high on/off ratio of black phosphorus caused by its considerable band gap.

Figures

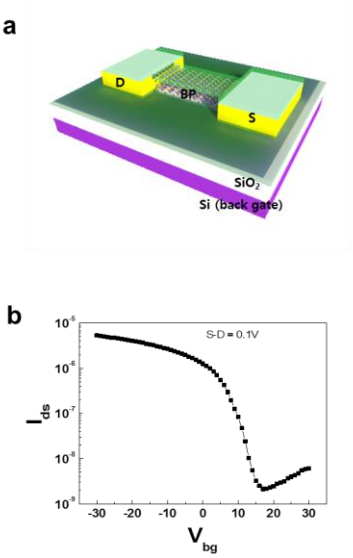

Figure 1: Field-effect transistor with black phosphorus channel.

References

[1] Likai Li, Yijun Yu, Guo Jun Ye, Qingqin Ge, Xuedong Ou, HuaWu, Donglai Feng, Xian Hui Chen and Yuanbo Zhang, Nature Nanotech, **9** (2014) 372-377