7th International Workshop on 2D Materials

Title of the Presentation: Semiconductor-less Vertical Transistor with I_{ON}/I_{OFF} of 10^6

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Short Biography:

I am a PhD student at department of physics at Konkuk university in Republic of Korea. My thesis is concerned with modulating a tunneling barrier height in graphene/hBN/metal heterostructure and its application to photodetector. In addition, I have researched a transfer method for 2D materials to make 2D heterostructure that has a clean interface.

Abstract:

Semiconductors have long been perceived as a prerequisite for solid-state transistors. Although new switching principles for nanometer-scale devices have emerged based on the deployment of two-dimensional (2D) van der Waals heterostructures, tunneling and ballistic currents through short channels are difficult to control, and semiconducting channel materials remain indispensable for practical switching. In this study, we report a semiconductor-less solid-state electronic device that exhibits an industry-applicable switching of the ballistic current. This device modulates the field emission barrier height across the graphene-hexagonal boron nitride interface with I_{ON}/I_{OFF} of 10^6 obtained from the transfer curves and exhibits unprecedented current stability in temperature range of 15-400 K. The semiconductor-less switching resolves the long-standing issue of temperature-dependent device performance, thereby extending the potential of 2D van der Waals devices to applications in extreme environments.

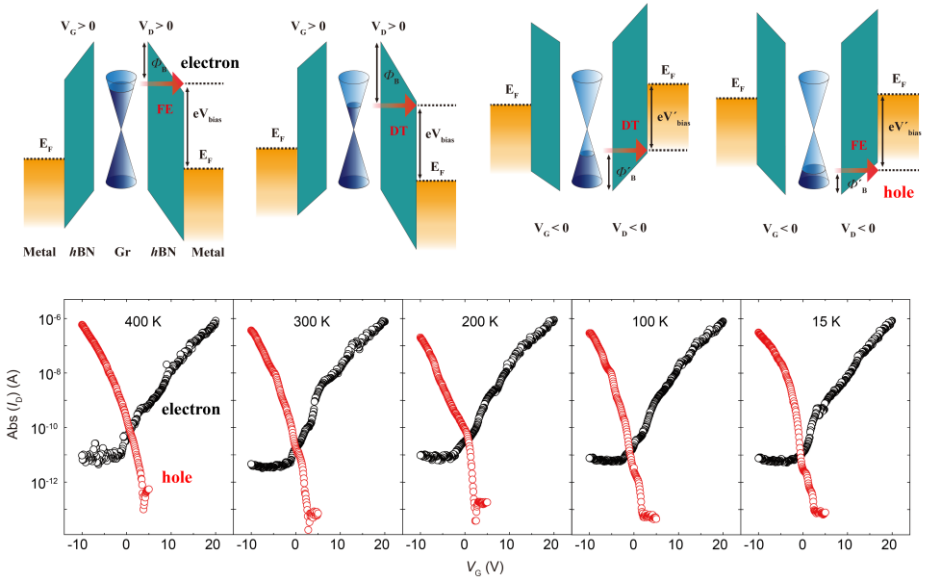

Fig. 1. Modulation of tunneling barrier height in field emission barristor and its I-V characteristics