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Micro-Scale Rectifying Ballistic Device Based on hBN Encapsulated Graphene

Abstract

In recent times, there has been a tremendous interest in graphene based ballistic devices. In this study, we have fabricated the ballistic devices based on high quality graphene encapsulated with hexagonal boron nitride (hBN) using dry-transfer method. The Raman spectra of the hBN-encapsulated graphene show a remarkably high ratio of intensity of 2D and G peaks (~12), whereas, the mobility is estimated as ~156,000 Vs⁻¹cm⁻¹. This mobility exceeds the value (~143,000 Vs⁻¹cm⁻¹) corresponding to 1 μ m mean free path at room temperature. Hence, it enables fabricating the micro-sized ballistic devices. The device based on long mean free path of carriers shown in Fig.1 exhibits a rectifying behavior with low threshold voltage at even < 5 mV. Moreover, the ballistic device based on hBN encapsulated graphene performs the rectifying behavior at high frequencies (up to 9 MHz). This promising device could be applied in energy harvesting field.

References

- [1] L. Wang, I. Meric; P. Y. Huang, et al, Science, 6158 (2013) 614-617
- [2] Luca banszerus, Michael Schmitz, et al, Nano Letter, 16 (2016), 1387-1391
- [3] Gregory Auton, Jiawei Zhang, et al, Nature Communications, 7 (2016) 11670
- [4] Xu du, Ivan Skachko, Anthony Barker, Eva Y. Andrei, nature Technology, 3 (2008), 491-495.
- [5] Alexander S. Mayorov, Roman V. Gorbachev, et al, Nano Leter, 11 (2011) 2396-2399.
- [6] K. I. Bolotin, K. J. Sikes, J. Hone, H. L. Stormer, P. Kim, 9 (2008) 098602
- [7] S. D. Sarma, Shaffique Adam, E. H. Hwang, Enrico Rossi, Reviews of Modern Physics, 2 (2011) 407-470

Figures



Figure 1. While the dc current is applied between S-D electrodes, dc voltage different between L-U electrodes is measured at different gate voltages. The insert shows the optical image of the rectifying device.