Quantized conductance in InSe heterostructure quantum point contacts

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Abstract

InSe is a graphene-like layered metal chalcogenide semiconductor to have a sizable band gap depending on the number of layer[1]. With electrostatic gating, we realized gate-defined nanosturucture, the quantum point contact in the InSe heterostucture encapsulated by hBN and graphene electrodes[2]. To overcome the schokkey barrier, the local top-gate is implemented to the device to achieve good contact between grapehene and InSe interface via gated doping. We perform two terminl transport measurement at T=4.2*K*. *Applying local top gates are enabling to form linear IV characterisitic. And applying split gates voltage can lead to deplete the electrons under the gate and the electron flow shows to be completely pinched off.* At the QPC channel, the plateu–like festure is observed at $2e^2/h$ after subtractting the contact resistance.

References

[1] D. Bandurin *et al.*, Nature, Nanotech, 242 (2016)1-6
[2] L. Wang *et al.*, Science, 342 (2013) 614-617

Figures

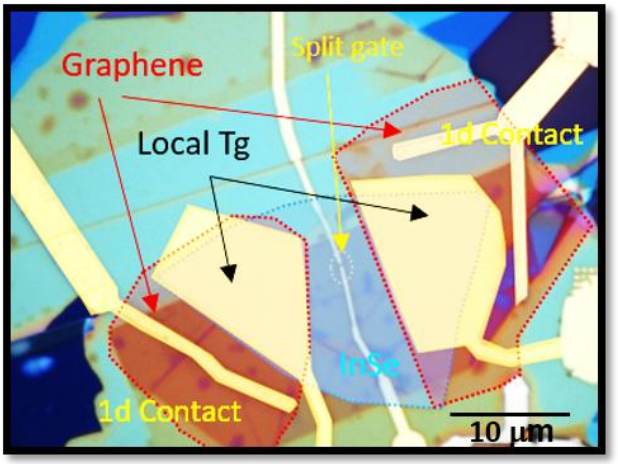

Figure 1: Optical image of the device. An encapsulated a few layer InSe (blue dashed line) is connected to two graphene electrodes (red dashed ines). 1d edge contact (Cr/Au) is fabricated to the graphene electrode. Local Tg and splite gates in the yellow dashed circle are to control the contact resistance and 1d QPC channel, respectively.

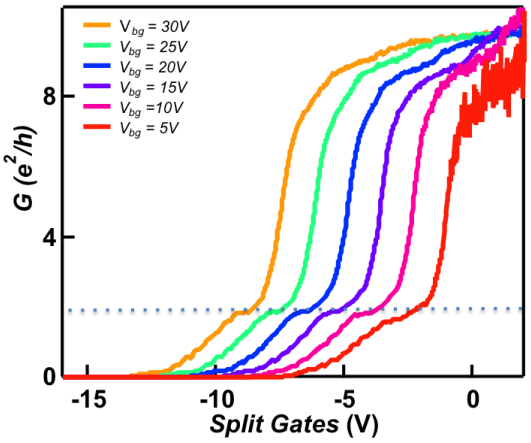

Figure 2: Conductance as a split gate voltage at the different V_{bg}. The QPC channel shows pinched off. And quantized plateau appears at $2\ e^2/h$.