

Microelectronic devices in graphene

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Graphene is the thinnest electronic material, merely one atom thick, with very high carrier mobilities, and therefore it should enable transistors operating at very high frequencies. Here, we have explored several routes to graphene-based electronics.

We mainly used monolayer, bilayer and tri-layer graphene flakes obtained by peeling graphite onto a Si wafer with a 300 nm SiO₂ top layer. We have processed several devices by using mainly e-beam nanolithography including Hall bars, FET and SET transistors and Quantum Rings.

To characterize the graphene quality we used micro-Raman and AFM studies previous to device processing. We first characterize our devices with quantum Hall effect (QHE) measurements to obtain density and mobilities as a function of the back gate.

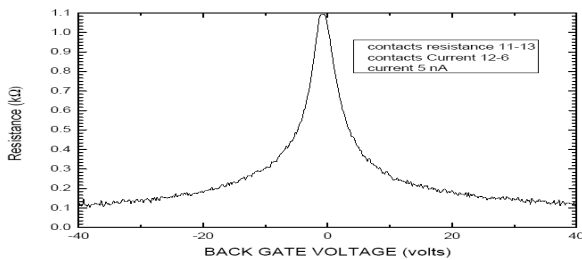
We measured the concentration of carriers for different voltages and extract a rule for each device.

We made several tests to check the quality of our sample. The integer QHE appears both by varying the gate voltage and the magnetic field.

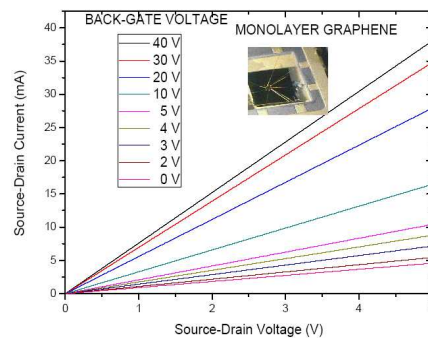
References

- [1] J. Caridad, F. Rossella, V. Bellani, M. Grandi, and E. Díez, Journal of Raman Spectroscopy (*in press*)
- [2] C. Faugeras, M. Amado et al. Phys. Rev. Lett. 103, 186803 (2009)
- [3] M. Amado, E. Díez et al., New Journal of Physics **12**, 053004 (2010)

Figures



a)



b)

Figure 1: a) The back gate allow us to change the carriers nature from hole (p) to electrons (n) changing the carrier density in several orders of magnitude. b) The output characteristics tuning the current with the back-gate contact. The back gate covers the whole device but this effect could be used in a more useful way creating top nano-gates allowing RF transistor working at very high frequencies

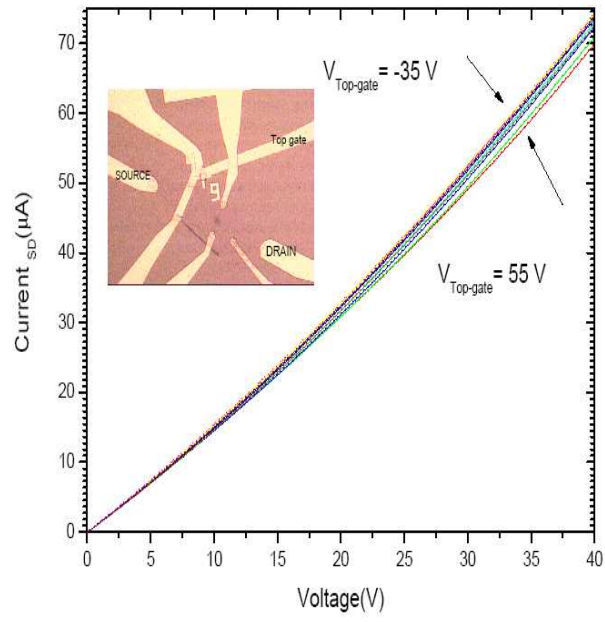


Figure 2: Output characteristics the transistor by applying different top gate voltages.