Ideal electrical transport using technology-ready graphene

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Producing and manipulating graphene on fab-compatible scale, while maintaining its remarkable carrier mobility, is key to finalize its technological application. We show that a large-scale approach (CVD growth on Cu followed by polymer-mediated semi-dry transfer) yields single-layer graphene crystals undistinguishable, in terms of electronic transport, from micro-mechanically exfoliated flakes [1]. hBN is used to encapsulate the graphene crystals – without taking part to their detachment from the growth catalyst – and study their intrinsic properties in field-effect devices. At room temperature, the electron-phonon coupling sets the mobility to $\sim 1.3 \times 10^5$ cm$^2$/Vs at $\sim 10^{11}$ cm$^{-2}$ concentration. At cryogenic temperatures, the mobility ($> 6 \times 10^5$ cm$^2$/Vs at $\sim 10^{11}$ cm$^{-2}$) is limited by the devices’ physical edges, and charge fluctuations $< 7 \times 10^9$ cm$^{-2}$ are detected. Under perpendicular magnetic fields, we observe early onset of Landau quantization ($B \sim 50$ mT) and signatures of electronic correlation, including the fractional quantum Hall effect.

References

[1] Sergio Pezzini, Vaidotas Mišeikis, Simona Pace, Francesco Rossella, Kenji Watanabe, Takashi Taniguchi, Camilla Coletti, https://arxiv.org/abs/2005.02284

This project has received funding from the European Union’s Horizon 2020 research and innovation programme Graphene Flagship under grant agreement No 881603