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 ~1.3 × 10^5 cm^2/Vs at ~10^11 cm^-2 concentration. At cryogenic temperatures, the mobility (> 6 × 10^5 cm^2/Vs at ~10^11 cm^-2) is limited by the devices’ physical edges, and charge fluctuations < 7 × 10^9 cm^-2 are detected. Under perpendicular magnetic fields, we observe early onset of Landau quantization (B ~ 50 mT) and signatures of electronic correlation, including the fractional quantum Hall effect.

References


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