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Twisted devices from CVD graphene

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Twisted 2D materials provide an extraordinarily rich platform for engineering emergent electronic, magnetic and optical properties. However, to help realizing the applicative potential of *twistronics*, synthesis and assembly techniques need to meet stringent requirements in terms of device-scale interface cleanness and twist-angle control.

We present recent advancements in the realization of dual-gated high-mobility devices based on twisted graphene layers synthesized via chemical vapor deposition (CVD). On the one hand, large-angle twisting can be stabilized at the growth stage [1], ensuring electronic decoupling and parallel transport between pristine graphene sheets with a gate-controlled carrier distribution [2]. On the other hand, small-angle configurations can be selected via hBN-mediated stacking of two separated crystals grown on a single Cu grain (see Fig.1, left). [3]. Low-temperature magnetotransport is employed to reveal the hallmarks of a 2.4°-twisted superlattice including tunable regimes of interlayer coupling, reduced Fermi velocity, large interlayer capacitance, and density-independent Brown-Zak oscillations (see Fig.1, right).

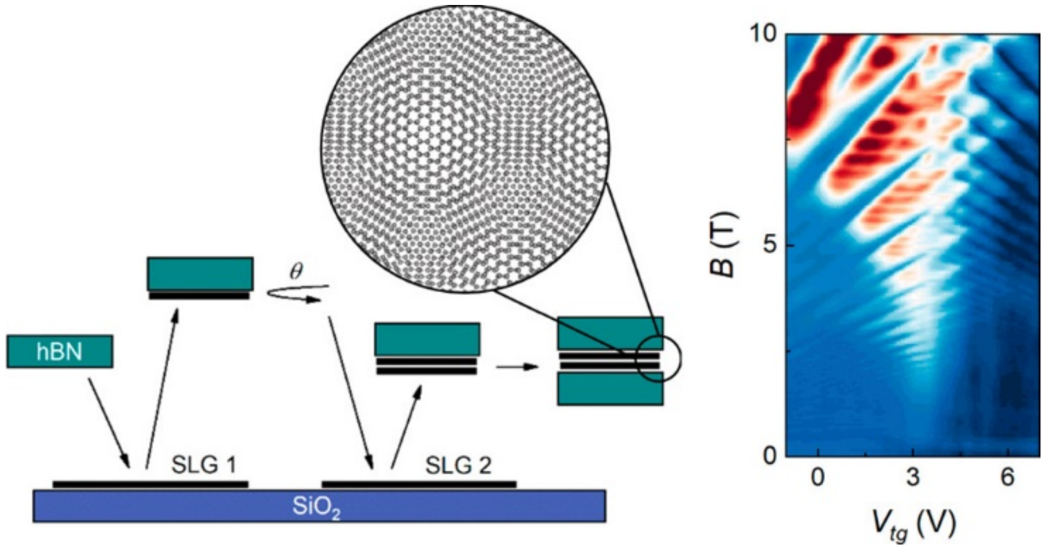

FIG. 1. Left: controllable assembly of twisted bilayer graphene from transferred CVD-grown crystals. Right: longitudinal resistance of 2.4°-twisted bilayer graphene as a function of top-gate voltage and magnetic field, measured in the vicinity of the electron-side van Hove singularity, where two Landau fans with opposite dispersion coalesce. Brown-Zak oscillations appear as horizontal strikes. Taken from Ref. [3].

[1] S. Pezzini *et al.*, *Nano Lett.* **20**, 3313-3319 (2020)
[2] G. Piccinini *et al.*, *Phys. Rev. B* **104**, L241410 (2021)
[3] G. Piccinini *et al.*, *Nano Lett.* **22**, 5252-5259 (2022)

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