ELECTRONIC TRANSPORT IN CORRUGATED GRAPHENE

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Graphene is known for its unique band structure, making it a great candidate for many electronic applications. However, it presents also astonishing mechanical properties [1], which can modify the usual behavior of the 2D material. Here, we report on the investigation of charge transport in corrugated hBN-encapsulated graphene devices (Fig. 1. a) and b)). We investigate our device by Raman measurements (Fig 1 c). Raman spectra show a periodic response due to the presence of the corrugation. Moreover, the position of peak 2D and G are clearly correlated, which is typical of the presence of strain in graphene [2]. From low-bias transport measurements at 4 K, we observe a clear signature of strain effects on transport properties by the emergence of a broad peak at high Vg., in contrast with unstrained graphene (Fig. 1 d)) [4]. The graphene is under a periodic stress, which can be seen as a Hamiltonian perturbation equivalent to applying periodic effective potentials to the graphene: a scalar potential and a pseudo vectorial potential [3]. We develop a model for ballistic transport through a strain barrier in graphene, showing that strain can induce valley separation (Fig 1 e)). This model reproduces both qualitatively and quantitatively the measured gate dependence of the resistance.

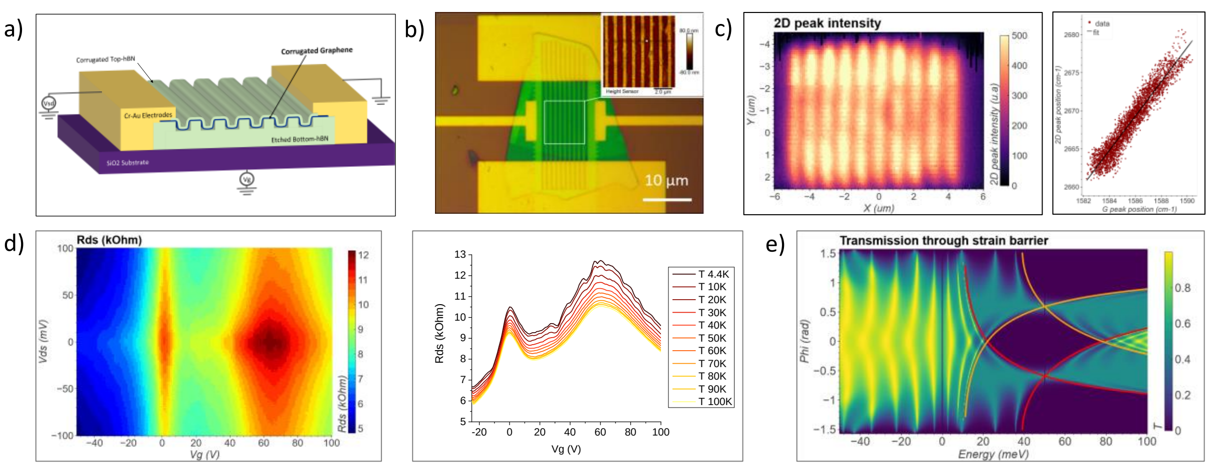

Fig. 1. ***a) - Principle*** *Schematic view of the corrugated hBN/graphene/hBN device* ***b) - Fabrication*** *Optical image of an encapsulated corrugated graphene. Inset: an AFM image of the corrugation* ***c) Raman spectroscopy*** *Map of the intensity of the 2D peak and correlation between the 2D and G peaks positions over the corrugated area* ***d) – Transport characterization*** *Left: Map of differential resistance R_{ds} as a function of the gate voltage V_g and of the bias voltage V_{ds} at T = 4.4 K Right: R_{ds} as a function of V_g at zero-biais for different temperatures (T = 4.4 K, 10 K, 20 K, 30 K, 40 K, 50K, 60 K, 70 K, 80 K, 90 K, 100 K).* ***e) – Theory*** *Transmission probability through a 150nm long strain barrier with uniaxial strain ε= 2% in the zigzag direction as a function of the electron energy E and the incidence angle on the barrier φ,. Red lines correspond to the limits of authorized incident angles for valley K and the orange ones for valley K'*

References
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