Atomically precise graphene nanoribbons for quantum devices

Jian Zhang,
Mickael L. Perrin, Oliver Braun, Gabriela Borin Barin, Liu Qian, Klaus Müllen, Pascal Ruffieux, Hatef Sadeghi, Jin Zhang, Roman Fasel, Michel Calame

Empa, Swiss Federal Laboratories for Materials Science and Technology, 8600 Dübendorf, Switzerland
jian.zhang@empa.ch

Atomically precise graphene nanoribbons (GNRs) have attracted much interest from researchers worldwide, as they constitute an emerging class of quantum-designed materials, all tailored by controlling their width and edge structure during the chemical synthesis [1-3]. The major challenges toward their exploitation in electronic applications include reliable contacting, complicated by their small size (5-100 nm length), and the preservation of their physical properties upon device integration. In recent years, the exploitation of GNR properties for electronic devices has focused on their integration into field-effect-transistor (FET) geometry [4-6]. However, such FET devices, due to the presence of a single gate, have limited electrostatic tunability. Here, we report on the device integration of armchair GNRs into a multi-gate FET geometry with graphene electrodes or single-walled carbon nanotube electrodes. With the above geometries, we measured the quantum dot behavior at low-temperature. By demonstrating the preservation of the armchair GNRs' molecular levels upon device integration, as demonstrated by transport spectroscopy, our study provides a critical step forward in the realization of more exotic GNR-based quantum devices.

References

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Figures

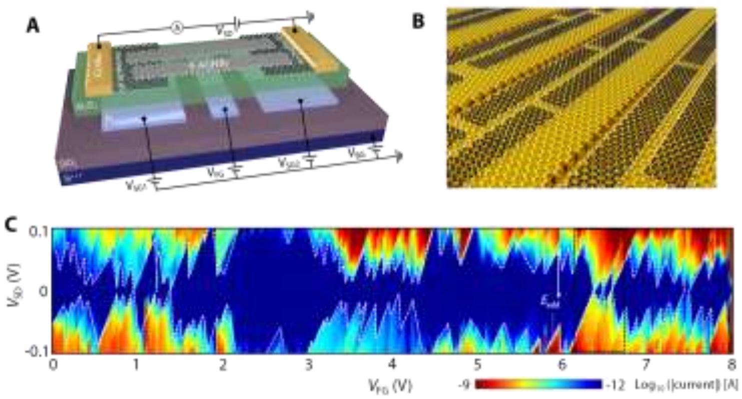

Figure 1: GNR device and the transport measurements. (A) Artistic illustration of a multi-gate 9-AGNR quantum dot device. (B) A sketch of the GNRs grown parallel to the Au(788) terraces. (C) Coulomb diamonds in a multi-gate 9-AGNRs device at low temperature.