The use of graphene electrodes for nanodevices with low-dimensional materials: the case of 1D graphene nanoribbons

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Molecular scale materials are a promising resource for the development of functional devices for the next generation of nanoelectronic components. The key challenge is how to address and exploit them in scalable architectures. Our idea is to use graphene as a suitable material for the realization of the contact electrodes in devices with low-dimensional systems. Indeed, the (2D) planar geometry of graphene reduces the "dimensionality mismatch", optimize the electrical coupling with the gate through reduced screening and allows for the anchoring of a wide variety of molecular compound through specific functionalization. In recent years, we have demonstrated the use of graphene electrodes for several class of low dimensional materials, form 0D magnetic molecules [1] to organic semiconductors thin films[2].
Here we focus on the use of graphene electrodes to contact atomically precise 1D graphene nanoribbons (GNRs), which represent the ultimate miniaturization of graphene devices with controllable edge properties and functionalities[3]. We report a systematic study on the structure-property relationship in GNR-based devices, enabled by the use of graphene electrodes, showing that the final electrical behavior is determined by the specific type of nanoribbon employed, in accordance in theoretical predictions[4]. Our results highlights the use of graphene in devices with low dimensional materials and the promising potential of "all-graphene" devices for electronic and optoelectronic applications[5].

References

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Figures

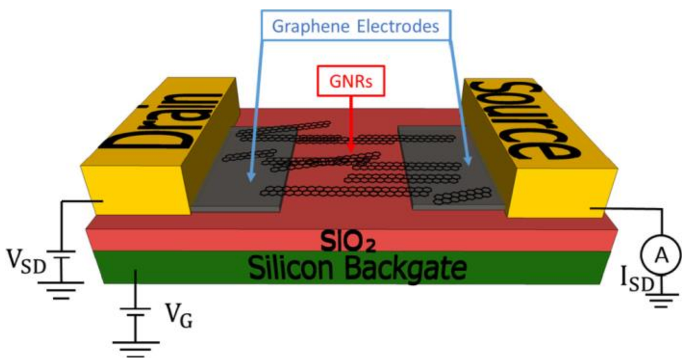

Figure 1: Schematic view of a GNR device with graphene electrodes