Engineering of Charge Current Flow in Nanoporous Graphenes

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ABSTRACT SUBMISSION

INTRODUCTION

During the last decade, on-surface fabricated graphene nanoribbons (GNRs) have gathered enormous attention due to their semiconducting π-conjugated nature and atomically precise structure.[1] GNRs are regularly characterized by means of scanning probe microscopy (SPM), which has also allowed to study exotic electronic quantum phases realized in these nanostructured materials.[2] A significant breakthrough in the same field was the fabrication of the nanoporous graphene (NPG) as a 2D array of laterally bonded GNRs,[3] as sketched in Fig. 1. This covalent integration of GNRs could enable complex electronic functionality at the nanoscale, particularly if one could tune the electronic coupling between GNRs within NPGs.

RESULTS

In this talk I will summarize recent efforts towards controlling current flow within NPGs either via rational chemical design[4] or via external means such as electrostatic gates.[5] Our most recent studies, based on quantum chemical calculations and large-scale transport simulations, generalize these ideas to other types of carbon nanostructures[6] and, importantly, demonstrate their applicability under practical use conditions, such as including the effect of electrostatic disorder or finite temperature (see Fig. 1).

CONCLUSION

A fundamental strategy to design carbon nanodevices with built-in externally tunable electronics is thus proposed, and should be key for future applications such as bio-chemical nanosensing and carbon nanoelectronics.

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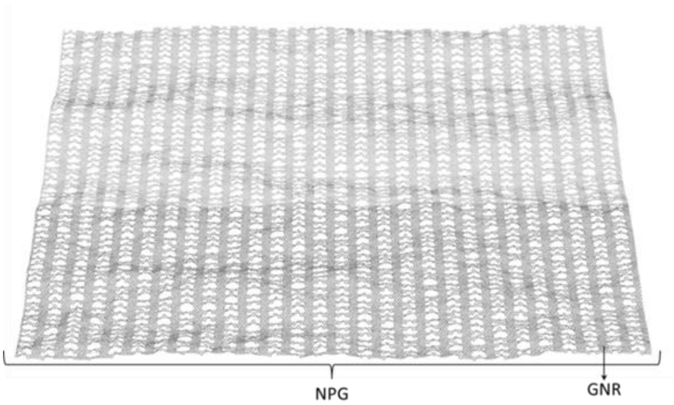

Fig. **1**. NPGs are made as 2D arrays of laterally connected parallel GNRs.