Atomically-precise graphene architectonics: 0D dots, 1D ribbons and 2D porous graphene

César Moreno

Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and The Barcelona Institute of Science and Technology, Campus UAB, Bellaterra, 08193 Barcelona, Spain.

On-surface reactions, via programmed interactions of molecular building blocks, has recently emerged as a promising route to synthesise atomically precise materials from the 'bottom-up'. This approach ensures exquisite atomic-scale control of the structural and chemical functionalization, allowing to design a vast number of carbon-based nanoarchitectures not available by traditional solution chemistry nor with the 'top-down' methodologies. In particular, graphene nanoribbons (GNRs) with different structures can be synthesized with atomic precision and fine-tuned electronic band gap.

In this talk, I will describe the recent advances in the on-surface synthesis field. Then, I will discuss our recent results to synthetize 0D dots[], atomically precise nanoporous graphene [2], graphene nanoribbons and their chemical functionalization and how to organize them into superlattices[3].

At the end of the day, this talk will demonstrate the full path to synthetize a semiconducting graphene material with a bandgap similar to that of silicon, its atomic-scale characterization, and its implementation in an electronic device. Further potential applications include in photonics and highly selective molecular filtration and sensing systems.

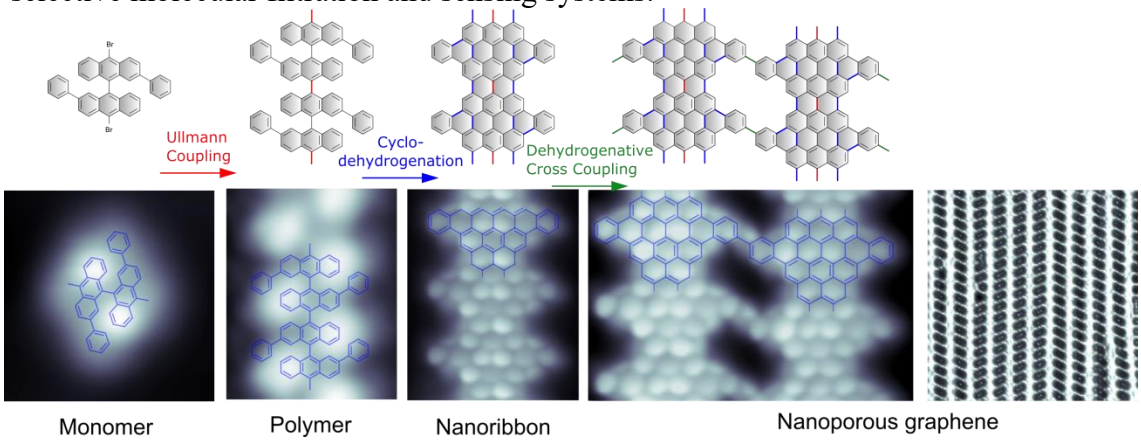

Figure 1. STM images (bottom) and schematic representation (top) of the precursor, intermediates and final product of the hierarchical synthesis of nanoporous graphene.

References

[1] S.O. Parreiras et al., Symmetry forbidden morphologies and domain boundaries in nanoscale graphene islands.2D Materials 4 (2), 025104 (2018)

[2] C. Moreno et al., Bottom up synthesis of multifunctional nanoporous graphene. Science 360, 199-203 (2018)

[3] C. Moreno, et al., On-surface synthesis of superlattice arrays of ultra-long graphene nanoribbons. Chem. Comm. 54, 9402-9405 (2018).