Atomically-precise 1D and 2D graphene nanoarchitectures

The manufacturing of 2D nanoarchitectures leads to materials with novel and highly tunable physico-chemical properties. On-surface reactions, via programmed interactions of molecular building blocks, has recently emerged as a promising route to synthesize 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, 1D 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 synthesize atomically precise 2D nanoporous graphene [1], 1D graphene nanoribbons and their chemical functionalization and how to organize them into superlattices[2,3].

At the end of the day, this talk will demonstrate the full path to synthesize 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 nanoelectronics, photonics and highly selective molecular filtration and sensing systems.

References

Figure

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