Graphene Nanopatterning at the Nanometer Scale

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The selective modification of pristine graphene represents an essential step to fully exploit its potential. Two main routes are usually followed to modify graphene properties. On one hand, bottom up approaches have demonstrated to be very efficient to change the overall electronic structure of graphene [1-3]. On the other hand, with top down approaches it is possible to induce such changes on a local scale [4,5]. Here we merge bottom-up and top-down strategies to tailor graphene with nanometer accuracy. Specifically, we have developed a perfectly reproducible nanolithographic technique that allows, by means of an STM tip, to modify with 2.5 nm accuracy the electronic properties of graphene monolayers epitaxially grown on Ir(111) surfaces. This method can be carried out also on micrometer sized regions and the structures so created are stable even at room temperature. As a result, we can strategically combine graphene regions presenting large differences in their electronic structure to design graphene nanostructures with tailored properties. Therefore, this novel nanolithography method could open the way to the design of nanometric graphene-based devices with specific functionalities.

References

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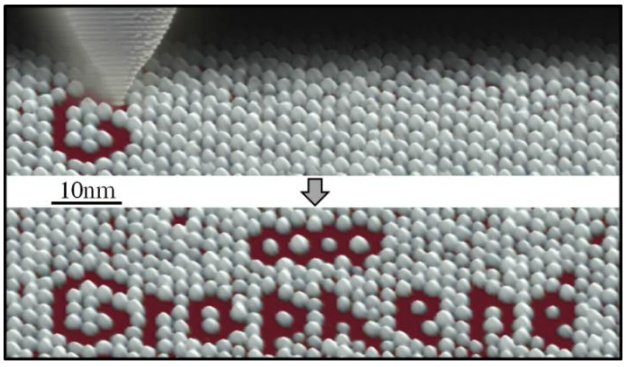

Figure 1. Upper panel illustrates the nanopatterning process, with a schematic STM tip drawn on top of a real experimental image. Lower panel shows a 95x35 nm^2 STM image with the final result after writing the word "graphene".