

Ph.D. Course in Materials Science and Nanotechnology

University of Milano-Bicocca, Department of Materials Science, via Cozzi 55, 20125 Milano

February 27, 2018 – 11.00 a.m.

Seminar room - Department of Materials Science U5

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Graphene growth on Ni(111)

By means of joint Scanning Tunneling Microscopy (STM) experiments and Density Functional Theory (DFT) ab initio calculations, we have recently characterized the different chemisorbed configurations of epitaxial graphene coexisting on a Ni(111) single crystal surface [1], providing also an atomic scale description of the structure of their edges both during and post growth [2]. Here we demonstrate, both experimentally and theoretically, the catalytic role played by single metal adatoms during this spontaneous and technologically relevant growth process. The elusive catalytic action of individual Ni atoms at the edges of a growing graphene flake is directly captured by STM imaging at the ms time scale, thanks to the Fast-scan add-on module recently developed in our laboratory, that is capable of providing video rate STM movies of surface process using a commercial STM system. DFT and force-field molecular dynamics calculations rationalize the experimental observations, yielding a full atomistic description of the growth mechanism [3], where the single atom Ni catalyst acts as a knitting needle, allowing new carbon stitches to be incorporated in the expanding graphene fabric. Our results represent a direct observation of a single atom catalyst at work during a surface catalysed process, providing straightforward evidence of the enhanced reactivity displayed by low-coordinated metal atoms in many model systems.

References:

- [1] F. Bianchini, L.L. Patera, M. Peressi, C. Africh, and G. Comelli, J. Phys. Chem. Lett. 51, 467 (2014).
- [2] L.L. Patera, F. Bianchini, G. Troiano, C. Dri, C. Cepek, M. Peressi, C. Africh, and G. Comelli, Nano Lett. 15, 56 (2015).
- [3] L.L. Patera, F. Bianchini, C. Africh, C. Dri, G. Soldano, M.M. Mariscal, M. Peressi, and G. Comelli, submitted.

PhD students and all interested in the seminar are kindly invited to participate.

The PhD Coordinator
Prof. Marco Bernasconi

Al termine del Seminario, il Prof. Comelli, in qualità di componente del Comitato Nazionale dei Garanti per la Ricerca (<https://cngri.miur.it/componenti/>) illustrerà brevemente alcuni aspetti generali del bando PRIN 2017.