

N-doped graphene: growth and reactivity

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Recently, substantial effort has been focused on the possibility to use graphene (Gr) as gas-reactor, -storage and -sensor. A viable route to reach this aim is the functionalization of graphene via the introduction of defects and/or doping. Theoretical calculations and experimental results report Nitrogen (N) as a good candidate to make graphene sensitive to gases like CO [1]. Furthermore, N-Gr grown on a Ni substrate was demonstrated to be a promising system for the so-called “catalysis under cover” [2], thus pointing to a possible key performance of N-Gr/Ni for nano-reactors.

To this purpose, a high-quality N-Gr layer is mandatory. We developed a new method for the production of homogeneous and flat N-Gr on Ni(111) and we characterized its structure and reactivity by Scanning Tunneling Microscopy (STM) and X-ray Photoemission Spectroscopy (XPS). Experimental results are corroborated by Density Functional Theory calculations and STM simulated images, which confirm the presence of graphitic and pyridinic N defects.

Exposure of N-Gr to near ambient pressure of CO at room temperature results in the intercalation at the Gr/Ni interface, forming ordered CO ad-layers. The comparison with previous experiments on the pristine Gr clearly demonstrates an enhanced reactivity, opening the way to a potentially scalable production of high-performance devices in the field of catalysis, gas sensing and storage.

We acknowledge support from MIUR (PRIN 2017 No. 2017NYPHN8), University of Trieste (FRA2018), MAECI (Project No. PGR00795).

References

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- [2] Wei M. et al., *J. Phys. Chem. C*, 119 (2015) 13590

Figures

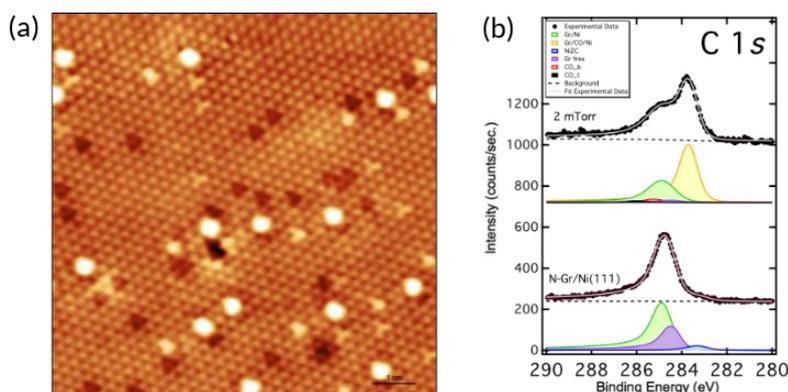


Figure 1: (a) STM image $9 \times 9 \text{ nm}^2$ of N-Gr on Ni(111). Bigger bright spots are Ni adatoms trapped in the Gr mesh. N defects are visible as dark and bright triangles. (b) XPS spectra of N-Gr before and after the exposure to CO. The C 1s peak shift indicates the intercalation of CO at the interface between Gr and the Ni substrate.