

Accepted Manuscript

Combining nitrogen substitutional defects and oxygen intercalation to control the graphene corrugation and doping level

Ana Martín-Recio, Carlos Romero-Muñiz, Pablo Pou, Rubén Pérez, José M. Gómez-Rodríguez



PII: S0008-6223(17)31350-7

DOI: [10.1016/j.carbon.2017.12.117](https://doi.org/10.1016/j.carbon.2017.12.117)

Reference: CARBON 12732

To appear in: *Carbon*

Received Date: 21 November 2017

Revised Date: 18 December 2017

Accepted Date: 29 December 2017

Please cite this article as: A. Martín-Recio, C. Romero-Muñiz, P. Pou, Rubén Pérez, José.M. Gómez-Rodríguez, Combining nitrogen substitutional defects and oxygen intercalation to control the graphene corrugation and doping level, *Carbon* (2018), doi: 10.1016/j.carbon.2017.12.117.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Combining nitrogen substitutional defects and oxygen intercalation to control the graphene corrugation and doping level

Ana Martín-Recio^{☆a}, Carlos Romero-Muñoz^{☆b}, Pablo Pou^{b,c}, Rubén Pérez^{b,a,*}, José M. Gómez-Rodríguez^{a,c,d,*}

^a*Departamento de Física de la Materia Condensada, Universidad Autónoma de Madrid, E-28049 Madrid, Spain*

^b*Departamento de Física Teórica de la Materia Condensada, Universidad Autónoma de Madrid, E-28049 Madrid, Spain*

^c*Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, E-28049 Madrid, Spain*

^d*Instituto Nicolás Cabrera, Universidad Autónoma de Madrid, E-28049 Madrid, Spain*

Abstract

By means of Scanning Tunneling Microscopy (STM) experiments and first-principles calculations, we demonstrate the synergetic effect of the combination of two different strategies to modify the properties of graphene supported on a strongly interacting substrate like Rh. A complete control of the corrugation and doping level is achieved combining the introduction of nitrogen defects and oxygen intercalation. Firstly, we show how to use ion bombardment to obtain purely-substitutional N-doped graphene on Rh(111) with tunable dopant concentration. In a second step, the interaction with the substrate is controlled by the amount of intercalated oxygen atoms. Unlike weakly interacting substrates, the highly corrugated structure of G/Rh(111) leads to remarkable variations of the electronic properties associated with nitrogen defects created in the high and low areas of the moiré. After oxygen intercalation, the N-doped graphene layer decouples from the substrate preserving the incorporated nitrogen atoms, which display a subtle dependence of the STM contrast. First-principles calculations confirm the identification of substitutional N-defects and the recovery of the Dirac cone with a tunable shift governed by the nitrogen concentration. Our results support the combination of different modification techniques to tailor structural and electronic properties of graphene and other 2D materials.

Keywords: Graphene, Nitrogen doping, Scanning Tunneling Microscopy, Density Functional Theory

[☆]These authors contributed equally to this work

*Corresponding Authors.

Email addresses: ruben.perez@uam.es (Rubén Pérez), josem.gomez@uam.es (José M. Gómez-Rodríguez)

Download English Version:

<https://daneshyari.com/en/article/7848578>

Download Persian Version:

<https://daneshyari.com/article/7848578>

[Daneshyari.com](https://daneshyari.com)