

Study of the electronic properties of functionalized graphene with diazonium chemistry

Gina Ambrosio^{1,2}

G. Drera¹, L. Daukiya², B. Hirsh², G. Di Santo³, L. Petaccia³, S. De Feyter², L. Sangaletti¹, and S. Pagliara¹

¹ I-LAMP and Dipartimento di Matematica e Fisica, Università Cattolica del Sacro Cuore.

² Division of Molecular Imaging and Photonics, Department of Chemistry, KU Leuven, Celestijnenlaan 200F, 3001, Leuven, Belgium,

³ Elettra Sincrotrone Trieste, Strada Statale 14 Km 163.5, 34149 Trieste Italy.

Contact@E-mail: Stefania.Pagliara@unicatt.it

Pristine graphene, at the K point of the Brillouin zone, is a gapless semiconductor with almost no density of states at the Fermi level [1]. Due to the small conductivity of graphene in this condition, various approaches are being explored to change the charge carrier concentration such as the direct doping through the chemical modification, either by the introduction of defects or through molecular adsorption. At the same time, an electronic bandgap in the graphene sheet is mandatory to develop the graphene-based electronic devices. Being simple and scalable, chemical modification is becoming a promising approach to functionalize graphene [2-3]. This method includes the covalent attachment of aryl based molecules onto the graphene surface [4].

In order to access the consequences of chemical modification on the graphene electronic structure, we carried out photoemission experiments. The graphene was chemically modified with 3,4,5-trimethoxy benzene diazonium (TMeOD). The Angular Resolved Photoemission Spectroscopy (ARPES) measurements performed at BadElph beamline in Synchrotron of Trieste and the X-Ray

Photoemission Spectroscopy (XPS) measurements allowed us to study the electronic structure at the interface and the modification of the electronic properties of the Dirac cone. These results are also interpreted on the basis of density functional theory (DFT) calculations carried out on TMD alone, as well as on TMD covalently bonded to graphene.

References

- [1] M. Sprinkle et al., PRL (2009) 103, 226803.
- [2] D. Bousa et al. *Nanoscale* (2016) 8, 1493-1502.
- [3] L. Daukiya et al., ACS Nano (2017), 11, 627-634.
- [4] J. Greenwood et al., ACS Nano (2015) 9, 5520-5535

Figure

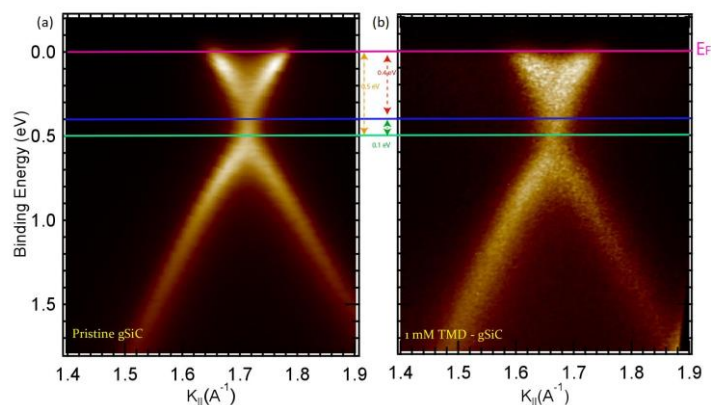


Figure 1: (a) ARPES measurements on pristine graphene on SiC and (b) 1 mM TMeOP grafted graphene on SiC