Transforming C_{60} into graphene: growth, structural and electronic characterization

J. Azpeitia[1], G. Otero-Irurueta[2], F. J. Mompeán[1], N. Ruiz del Árbol[1], I. Palacio[1], A. Gutiérrez[3], M. García-Hernández[1], J. A. Martín-Gago[1], C. Munuera[1], M. F. López[1]

[1] Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), Madrid, Spain
[2] Center for Mechanical Technology and Automation (TEMA), University of Aveiro, Aveiro, Portugal
[3] Departamento de Física Aplicada, Universidad Autónoma de Madrid, Madrid, Spain

The synthesis of large-area high-quality graphene layers through inexpensive procedures is mandatory for implementing the commercial use of this material in real applications. Several growth methods have been reported to date. Among them, physical vapor deposition (PVD) from a suitable organic precursor emerges as an advantageous route, since lower substrate temperatures are required to produce graphene [1-2]. Additionally, the use of low carbon solubility Cu substrates for PVD graphene growth results attractive due to its inexpensiveness and the possibility of post-growth graphene transfer on arbitrary substrates [3].

In the present work, we have grown graphene layers from C_{60} by physical vapor deposition in ultra-high vacuum conditions on polycrystalline oxygen-free Cu foils. With the aim of preparing the surface of the substrate prior to carbon evaporation, several cycles of Ar-sputtering and thermal annealing were performed. This procedure guarantees the cleanliness of the surface and also promotes the growth of well-oriented large Cu terraces, especially suitable for LEED analysis (figure 1a-b). After graphene growth was complete, sample analysis was performed with different techniques to characterize the structural and electronic properties of the graphene layer. In-situ LEED patterns show well defined spots corresponding to (111) and (100) Cu reflections and also exhibit an almost continuous ring corresponding to graphene in various orientations with respect to the Cu grains (figure 1c). Ex-situ atomic force microscopy (AFM) and Raman spectroscopy were employed to gather information on sample morphology and quality (figure 1d).

Angle resolved photoemission spectroscopy (ARPES) measurements have been carried on to determine the electronic band structure (figure 1e). Additionally, X-Ray photoemission spectroscopy was also performed to check the chemical composition of the surface.

We are currently optimizing graphene transfer to insulating substrates with the aim of determining its bandgap and macroscopic and local magneto-transport properties.

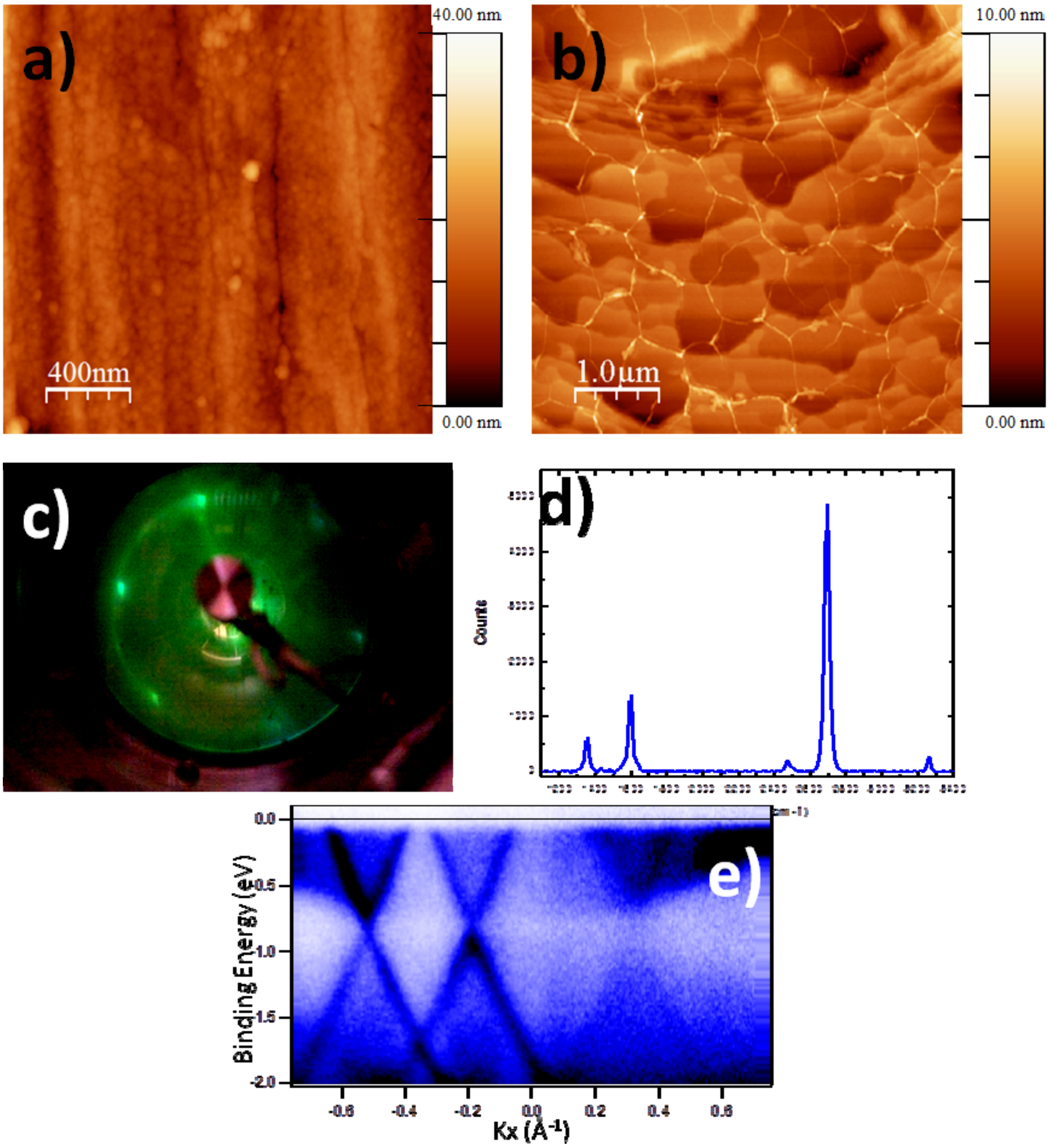

Figure 1: AFM topographic image of Cu foil substrate (a) before and (b) after cleaning treatments and graphene deposition. (c) LEED pattern at 100eV of as-grown graphene on Cu (111) domain grain. (d) Raman spectra of graphene covered Cu foil (background subtracted)**.** e) ARPES band structure of the π bands near E_F at a high symmetry point.

References

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