Chemically converted Graphene Nanosheets: Langmuir-Blodgett deposition

B. Martín-García[1], M.M. Velázquez[1], E. Diez[2], F. Rossella[3], V. Bellani[3], J.A. Pérez-Hernández[4] and J. Hernández-Toro[4]

[1]Dpto Química-Física, Universidad de Salamanca, Plaza de los Caídos s/n, 37008 Salamanca (Spain)
[2]Laboratorio de Bajas Temperaturas, Universidad de Salamanca, 37008 Salamanca (Spain)
[3]Dipartimento di Fisica "A. Volta", Università di Pavia, 27100 Pavia, (Italy)
[4]Centro de Láseres Pulsados Ultraintensos (CLPU), 37008 Salamanca (Spain)
beamagaiq@usal.es

Graphene has attracted much interest because of its superior physical, chemical and mechanical characteristics that make possible its use for thin-film transistors, solar cells, and sensor applications [1]. This material is a single layer of graphite with a perfect sp^2-hybridized 2D carbon structure. Graphene has been made by chemical vapor deposition, epitaxial growth or micromechanical exfoliation; nevertheless, the uniform growth of graphene monolayer is still a challenge. One of the most promising alternative options, developed in the last years, is the reduction of graphite oxide (GO) in colloid dispersions or in films adsorbed in solid substrates, however the low productivity of these methodologies make it unsuitable for large-scale applications [2]. Moreover, dispersions of graphene-sheets offer a great deal of flexibility in the creation of novel graphene-based nanocomposites with many others molecules and nanostructures [3]. According to it, the aim of this work is the preparation and characterization of graphene layers obtained from reduction of GO by different methodologies. In the first one, aqueous dispersions of GO were reduced by several reducing agents in the absence and presence of surfactants forming aqueous dispersions of graphene nanosheets. The chemically converted graphene, obtained by filtration and sonication, is a water-insoluble material suitable to form Langmuir monolayers. Thus, these graphene monolayers are transferred onto silicon wafers using the Langmuir-Blodgett (LB) technique. The third methodology explored in this work is to transfer GO onto silicon by LB technique and then chemically reduced.

The sheet morphology was observed by Atomic Force Microscopy (AFM) and shows that the LB technique offers us a great control over the orientation and placement of the sheets on the substrates. All routes lead to a few-layer graphene. The presence of surfactants in the reduction process of the GO aqueous dispersions produces lighter graphite flakes. Comparison between the Raman spectra of graphene sheets prepared by the different methodologies and the graphene obtained by micromechanical exfoliation (scotch tape) provides us useful information about the properties of the graphene materials sheets.

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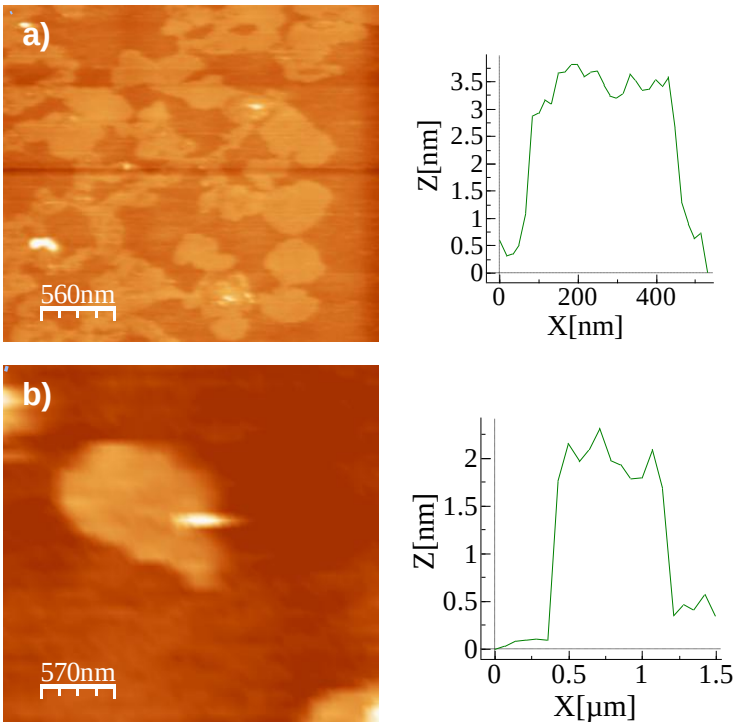

Figure 1. AFM images and line profiles for chemically reduced graphene nanosheets LB deposited onto silicon wafers. Reducing agents: hydrazine (a) and vitamin C (b).

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