Hybrid Redox Interfaces on Monolayer Graphene

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Abstract

Miniaturized organic-electronics is a broad field of research with several applications ranging from medical (bio) sensing to energy conversion devices [1,2]. Regards to the obtention of miniaturized devices, the efficient control of the anchoring of organic and redox active organic elements on to modified surfaces remains a challenge, especially when miniaturized scale devices are intend. For the last, monolayer graphene has gained special attention.

The possibility to modulate the chemistry properties and density of charge at the interface of monolayer graphene is still an open question regards to the fundamental study of charge transfer reactions at which the interfacial electron transfer of an active molecule or even a biomolecule are taking place [3]. One of the simplest methods for the control of the functionalisation of carbon materials or even monolayer graphene electrodes is by the use of non-covalent or covalent grafting of organic/inorganic molecules on to the surface, such as by the use of amino-derived organic molecules that can be electrograft on to the surface of graphene.

Herein, we have successfully modulate the chemistry and electrochemical properties of monolayer graphene electrodes by non-covalently attachment with 4-aminobenzylamine (4-AbA) molecules for subsequent attachment of methylene blue N-Hydroxysuccinimide ester (MB-NHS). The focuses are: (i) the systematic evaluation of the efficiency and the electrochemical stability of the modified monolayer graphene electrodes; (ii) the evaluation of the influence on the thickness of AbA on the electrochemical properties of MB attached to the surface and; (ii) the sensing properties of the obtained miniaturized redox hybrid interfaces based on monolayer graphene. The scheme for the obtention of hybrid redox interfaces on monolayer graphene in each step (i) to iii))are shown in figure 1.

i) Gr

ii) Gr/AbA

iii) Gr/AbA-MB

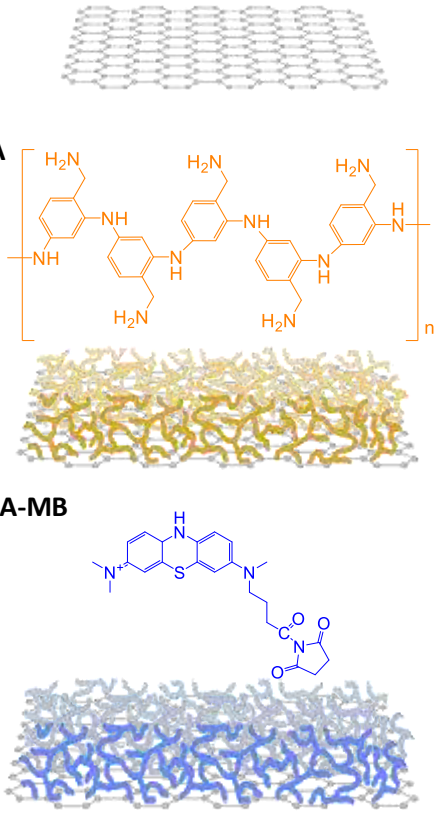

Figure 1. Scheme of Functionalisation of monolayer graphene electrodes for the obtention of hybrid redox interfaces.

References

[1] Chidsey and Murray. Science, 231 (4733), (1986), 25-31.
[2] Iost et. al, Nanotechnology, 1, 2016, 29LT01.
[3] Balasubramanian and Kern, Adv. Mater. 26, (8), (2014), 1154-1175.