Graphene for electrochemical biosensing platforms

B. Pérez-López[1,2], L. Baptista-Pires[1], S. Miserere[1], A. Merkoçi[1,4]*

[1] Nanobioelectronics & Biosensors Group, Catalan Institute of Nanotechnology, CIN2 (ICN-CSIC), Universitat Autònoma de Barcelona, Bellaterra, Spain.
[2] LEITAT Technological Center, Terrassa, Barcelona, Spain.
[3] Technical University of Catalonia, Barcelona, Spain.
[4] ICREA, Spain.
*arben.merkoci@icn.cat

Abstract

The integration of graphene within biosensing systems has received increased attention due to their physical, optical and chemical properties (which are not available in other materials) such as the interesting molecular structure, high surface area and high conductivity capacity that improves the electron transfer [1,2]. Most of the graphene based electrodes for electroanalytical applications are based on physical adsorption of graphene onto electrode surfaces, usually glassy carbon [3]. Given the special chemical and physical properties of special interest in electrochemical biosensors are the graphene uses as catalytic tools, immobilization platforms or electroactive labels to improve the (bio)sensing systems so as to achieve higher sensitivity, stability, and selectivity. Furthermore, graphene based biosystems are also bringing advantages in terms of the design of novel biodetection strategies.

A special attention to graphene preparation and characterization prior its integration into electrochemical sensors must be shown. To avoid some rather complicated synthesis alternative methods to produce graphene oxide and post reduced graphene oxide have been developed. These materials have advantages due to their properties and facility to be conjugated with different compounds such as enzymes, proteins, DNA and even cells. In this work we will present different studies performed at our labs so as to achieve single layer graphene oxide starting from different carbon materials such as graphite, carbon nanotubes, carbon nanofibers and highly oriented pyrolitic graphite (HOPG). We employ electrochemical and chemical alternatives and try to tune the synthesis versus the different and 'personalized' graphene properties with interest for either electrochemical or optical biodetection. In addition we will present some preliminary results related to an enzymatic (tyrosinase) electrochemical (bio)sensing along with aspects related to its incorporation into a screen-printed electrode platform, electrochemical and optical characterization of the sensing area including the obtained performance in terms of reproducibility, sensitivity, detection limit and response range.

References

[1] Geim A.K., Novoselov K.S., *NatureMaterials*, 6 (**2007**) 183-191.

[2] Frank O., Tsoukleri G., Riaz I., Papagelis K., Parthenios J., Ferrari A.C., Geim A.K, Novoselov K.S., Galiotis C., *Nature Communications*, 2, (**2011**), 255-261.

[3] Wang Y., Wan Y., Zhang D. *Electrochemical Communications*, 12, (**2010**), 187-190.