

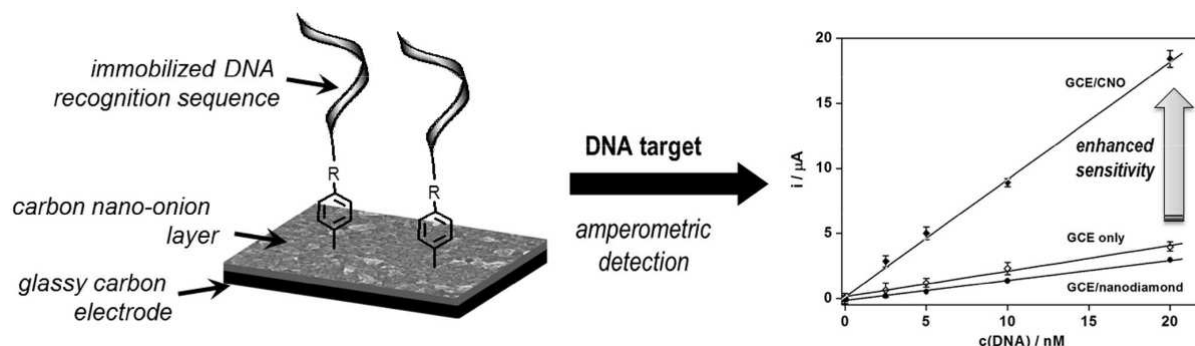
Preparation and characterization of carbon nanoonions modified electrodes for biosensor applications

Joanne P. Bartolome^a, Alex Fragoso^{a*}

Nanobiotechnology & Bioanalysis Group, Departament d'Enginyeria Química
Universitat Rovira i Virgili, Avinguda Països Catalans 26, 43007 Tarragona, Spain
joanne.pinera@urv.cat

Abstract

Carbon nanoonions (CNOs) are multilayered fullerenes concentrically arranged one inside the other that can be prepared using different carbon precursors.^[1-2] Although they have been less studied as compared with other carbon allotropes such as nanotubes and graphene, they possess interesting properties such as higher surface area and improved electronic properties. Moreover, to exploit the inherent electrochemical properties of CNOs, they have been chemically functionalized or incorporated in composites^[3-6]. Here we report the preparation of CNOs by thermal annealing of nanodiamonds and their incorporation in glassy carbon electrodes (GCEs) followed by electrochemical grafting of diazonium salts bearing carboxylic acid or maleimide terminated groups. The modified surfaces were used for the design of amperometric genosensors and immunosensors. Briefly, the DNA sensor has been developed using human papilloma virus (HPV) model system with horseradish peroxidase (HRP)-as labelled probe, whereas, an IgG sensor used alkaline phosphatase (ALP) as labelled probe. Both of the systems with modified GCE/CNOs showed enhanced analytical performance such as lower limit of detection and higher sensitivity as compared to non-modified GCEs. They were also tested in real samples.



References

- [1] V. L. Kuznetsov, A. L. Chuvilin, Y. V. Butenko, I. Y. Mal'kov, V. M. Titov, *Chemical Physics Letters*, **222** (1994) 343-348.
- [2] J. Cebik, J.K. McDonough, F. Peerally, R. Medrano, I. Neitzel, Y. Gogotsi, S. Osswald, *Nanotechnology*, **24** (2013) 205703.
- [3] J. Breczko, K. Winkler, M.E. Plonska-Brzezinska, A. Villalta-Cerdas, L. Echegoyen, *Journal of Materials Chemistry*, **20** (2010) 7761-7768.
- [4] M.E. Plonska-Brzezinska, J. Mazurczyk, B. Palys, J. Breczko, A. Lapinski, A.T. Dubis, L. Echegoyen, *Chemistry a European Journal*, **18** (2012) 2600-2608.
- [5] M.E. Plonska-Brzezinska, M. Lewandowski, M. Blaszyk, A. Molina-Ontoria, T. Lucinski, L. Echegoyen, *CHEMPHYSCHEM*, **13** (2012) 4134-4141.
- [6] J. Luszczyn, M.E. Plonska-Brzezinska, A. Palkar, A.T. Dubis, A. Simionescu, D.T. Simionescu, B. Kalska-Szostko, K. Winkler, L. Echegoyen, *Chemistry a European Journal*, **16** (2010) 4870-4880.