Potentialities of hybrid nanocomposites based on RGO and Au NPs towards electroanalytical applications

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A novel "*in-situ*" synthesis of colloidal Au nanoparticles (Au NPs) anchored onto Reduced Graphene Oxide (RGO) flakes is presented. In particular, RGO is functionalized with 1-aminopyrene or 1-pyrene carboxylic acid, and the end functionalities of pyrene act as a heteronucleation and growing sites for the Au NPs, which have been synthesized with different sizes (ca. 2-3, 10 and 20 nm) and capping ligands (amine or thiol).

A deep electrochemical characterization of the as prepared hybrid nanocomposites has been performed, focusing on the role played by the single components, by means of Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopy (EIS) measurements.

Synergistic effects, yielding to the enhancement of the system electroanalytical properties, are highlighted. The key point to understand the peculiarities of these innovative materials is the charge transfer from the Au NPs to RGO, assisted by the pyrene linker. These nanocomposites were applied in electroanalytical sensors for the detection of both organic and inorganic target molecules, such as As, dopamine and H_2O_2. In particular, in the case of dopamine, a LOD of (0.46 ± 0.02) ppb has been reached, comparable with other electroanalytical results of literature and in accordance with the benchmark for this molecule [1, 2]. For As detection, appropriately adjusting the experimental conditions, the hybrid devices show increased performances, also allowing speciation between As(III) and (V). In the case of H_2O_2, the hybrids platforms have been demonstrated ideal for developing oxidoreductase-based electrochemical biosensors, displaying high electrocatalytic activity and fast electron-transfer kinetics.

[1] J.A. Ribeiro, P.M.V. Fernandes, C.M. Pereira, F. Silva, *Talanta* **160** (2016) 653-679
[2] G. Soliveri, V. Pifferi, G. Panzarasa, S. Ardizzone, G. Cappelletti, D. Meroni, K. Sparnacci, L. Falciola, *Analyst* **140** (2015) 1486-1494

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