Study of the graphene oxide reduction and its impact in biosensing

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Fast detection of biomarkers is one of the pillars of medical diagnosis, and a major driving force for the health industry. Carbon-based electrochemical sensors are widely developed because of their low cost and biocompatibility. In terms of sensitivity, graphene-based materials, such as reduced graphene oxide (rGO), present a large electroactive surface area and good electron transfer kinetics. In the literature, one can find a wide dispersion concerning the rGO sensitivity to a specific analyte, which origin can be explained by several factors including the GO preparation protocol, the reduction method and the ability of modifying the material by interfacing with e.g. metallic nanoparticles [1].
In this work, we combine *in situ* atomic force microscopy (AFM) and Raman spectroscopy [2] to explore the electrochemical reduction of the GO material previously annealed under different conditions of temperature, pressure and time. The reduction degree of the GO material can be traced by the evolution of the Raman spectrum, also implying changes in the sample roughness and morphology. As a model experiment of the biomolecular sensing schemes, the sensitivity to hydrogen peroxide (a sub-product in the oxidation reaction of glucose by the enzyme glucose oxidase) [3] of the so-reduced GO materials is explored by means of impedance spectroscopy. WASP project funded by the European Union's Horizon 2020 research and innovation programme under grant agreement N°825213.

References

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Figures

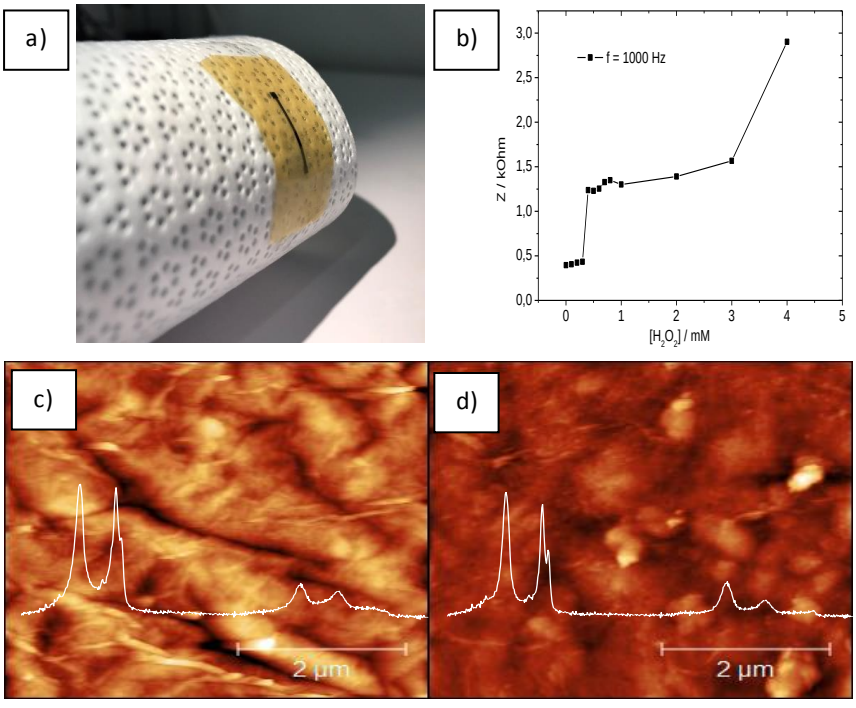

Figure 1: a) Flexible biosensor based on rGO. b) Electrochemical impedance (at 1kHz and 0.2V) of rGO as a function of H_2O_2 concentration. AFM images and Raman spectra before (c) and after (d) hydrothermal treatment (134°C, 3h). Z scale 115 nm.