Carbon-based nanomaterials in electrochemical sensing: the role of oxidized functional groups

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Non-invasive sensors, which accurately measure biomarkers of physiological interest in biological fluids, can allow a more personalized approach to fitness goals and to health monitoring. As an example, important analytes such as glucose and lactate, present in sweat, can be monitored by enzymatic biosensors exploiting an electrochemical transduction. In addition, some drugs of abuse can be detected in urine and saliva samples by exploiting their direct electrochemical oxidation on a conducting substrate [1]. In all these cases, the use of carbon-nanosized materials as the sensing element can strongly improve the efficiency of the electrochemical detection.

This presentation will discuss the role played by different oxygenated functional groups spontaneously present on carbon-based nanomaterials in the performance of the resulting sensor system [2]. Their direct interaction with target analytes and their role in stably fixing suitable bioreceptors will be addressed trying to find a correlation between the chemical composition of the material and the analytical performance finally obtained. Results coming from electrochemical, spectroscopic and morphologic analyses are combined to obtain new insights on the role played by different moieties in electrochemical sensing. This approach allowed us to direct the synthesis of the material acting as the sensing element in order to obtain sensors working at best for the specific application sought. Examples discussed in this presentation will include sensors exploiting graphene oxide, carbon nanotubes and carbon black (Figure 1), finding common behaviour among these nanosized materials.

References

[1] G. Maccaferri et al. Sens. Act. B 281 (2019) 739–745.
[2] G. Maccaferri et al. Carbon 120 (2017) 165-175.
[3] F. Vulcano et al. 2D Materials 7 (2020) 024007.
[4] A. Heras et al. Sensors 19 (2019) 518-529.

Figures

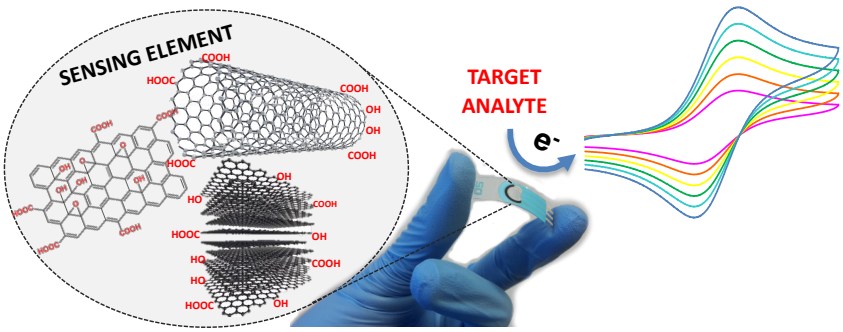

Figure 1. Approach to electrochemical sensing by carbon nanosized materials