**Electrochemistry: a powerful tool for synthesis**

**and characterization of nanomaterials**

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Nanomaterials, e.g., carbon-based, metal nanoparticles, conducting polymers, represent excellent candidates for a wide range of applications, including catalysis, imaging, biotechnology, and sensing. For sensing applications, nanomaterial-modified electrodes present numerous benefits [1], such as:   
high electroactive area, fast electrochemical reaction (electrocatalysis), low trace level of quantification, high selectivity, among others.

Electrosynthesis is a simple and rapid method to prepare nanomaterial-modified electrodes with desired properties. In this sense, cyclic voltammetry (CV) is the most used electrochemical technique. CV offers fast location of redox potentials of the electroactive species and permits the convenient evaluation of the influence of the media upon the redox process [2,3]. CV can be coupled with electrochemical quartz crystal microbalance (EQCM) to offer additional information during electrosynthesis. The EQCM can monitor the changes in the mass of the electrode, that can be associated with the nanomaterial film deposited [4].

For the characterization of the nanomaterial-modified electrodes, CV is also the election technique, because has the ability to rapidly furnish crucial information on the thermodynamics of redox processes, the kinetics of heterogeneous electron-transfer reactions, and coupled chemical reactions or adsorption processes [5,6]. Additional to CV, differential pulse voltammetry (DPV) can be used, since provides improved selectivity and resolution for observing different redox processes [7]. Electrochemical impedance spectroscopy (EIS) has been also shown to be a valuable tool for characterization of nanomaterials-modified electrodes. EIS has demonstrated its ability for investigating the architecture of sensing platforms, as well as for quantitative impedimetric sensing of key analytes [8].

The synthesis and characterization of different nanomaterial-modified electrodes will be presented and the benefits of using electrochemical techniques for these purposes will be discussed.

**References**

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