Carbon nanotubes as platforms for electrochemical and electronic detection of biorecognition processes

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The outstanding mechanical, electronic and optical properties of carbon nanotubes (CNTs) mostly determined by their one-dimensional character[1-2], make them extremely attractive for the design of novel sensing devices[3]. Among such devices, the CNT electrochemical sensors and the electronic field-effect CNT sensors (CNT-FET) have turned out to be very attractive tools for biomolecule sensing (enzymes, proteins, ADN, etc.) and for the monitoring of biological processes. The proper construction and orientation of the CNT-based electrode platform is a critical key point for its electrochemical response[4]. In this direction, different CNT configurations have been electrochemically evaluated in order to achieve the system with highest sensitivity and the fastest response.

One of the most interesting approaches is the label free biorecognition on CNT platforms in which no external modification on the biomolecules is required[5]. Different strategies for label-free protein detection (based on aptamer modified CNT devices), for genosensing and for monitoring biological process (i.e. with the immobilization of redox proteins on an electrode) have been developed. We have used different electrochemical detection techniques such as impedance spectroscopy in presence of a reversible redox indicator in different electrodes, cyclic voltammetry, chronocoulometry and electronic detection in an oligonucleotide-modified CNT-FET configuration under aqueous environment. For all approaches different functionalization schemes have been evaluated.

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