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Modified Electrodes by carbon nanotubes nanocomposites for hydrogen peroxide detection

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Abstract – Modified electrodes have been obtained by LbL technique. The different architectures of the LbL films were characterized by TEM (Fig. 1) and AFM. They are highly porous, with the SWCNT more agglomerate in the PAMAM nanocomposites. Callibration curves (Fig. 2) shows that the (CHIT/SWCNT) films are more sensibility to the (PAMAM/SWCNT) films.

The literature reports that the majority of commercially available electrochemical biosensors use a specific group of oxidoreductase enzymes as the biological recognition elements [1,2,3]. These enzymes are able to oxidize their specific substrate by molecular oxygen producing H_2O_2 as a side product [2]. The electrochemical detection of either O_2 consumption or H_2O_2 production in such biosensors plays a key role in the signal generation [3]. The polyelectrolytes chitosan and polyamidoamine (PAMAM) were chosen for be used in a polyelectrolyte in SWCNT nanocomposites for sensing applications because their properties of interaction with enzymes. The aim is to exploit the control of LbL architectures to enhance the catalytic efficiency of SWCNT for the hydrogen peroxide detection. The films were investigated by atomic force microscopy (AFM), transmission electron microscopy (TEM).

Electrical resistivity measurements of the layer-by-layer (LbL) films were performed with a Keithley electrometer as the source. Cyclic voltammograms and cronoamperograms were taken with an EG&G PAR M280 potentiostat in LbL films with 1, 3, 5, 7 and 9 bilayers on ITO as working electrode.

Different nanostructures were obtained in the two nanocomposites. The nature of these nanostructures was characterized by TEM (figure 1) and Atomic Force Microscopy (AFM). Figure 1 shows the high porosity obtained in the (CHIT/SWCNT) films and the high agglomerate of the carbon nanotubes in the (PAMAM/SWCNT) films. The effect of the addiction of carbons nanotubes in the LbL films of CHIT and PAMAM was studied by cyclic voltammetry. The calibration curves in the figure 2 were obtained by addiction of hydrogen peroxide in the electrochemistry cell. These nanocomposites modified electrode provided a novel electrode platform for the immobilisation of oxireductases enzymes because their the highest sensitivity to hydrogen peroxide.

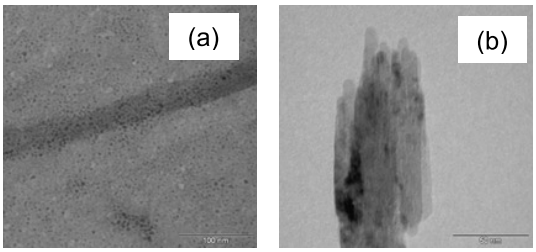

Figure 1: TEM image of (a) (CHITOSAN/SWCNT) and (b) (PAMAM/SWCNT) film

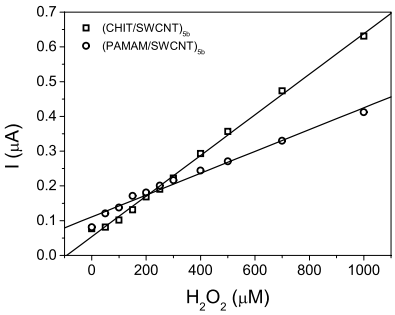

Figure 2: Calibration Curves of (**a**) $(CHIT/SWCNT)_{5b}$ and (**b**) $(PAMAM/SWCNT)_{5b}$.

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