Thin films of electron conducting carbon nanotubes and electro-active metallo-phthalocyanines: surface analysis and enhanced electrocatalysis

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Surface techniques (spectroscopic, microscopic and electrochemical) were utilized in the reported work for modified surface analysis. The results confirmed the immobilization of different species, i.e. carbon nanotubes and metal tetra-amino phthalocyanines (MTAPc). MTAPc containing cobalt (CoTAPc) and manganese (MnTAPc) as central metal ions were investigated. The method of immobilization, i.e. covalent attachment, confirmed the modification of electrode surface with the carbon nanotube-MTAPc conjugates yielding very stable thin films. The modified surfaces exhibited excellent electrochemical properties based on the electron-transfer in presence of ferri/ferrocyanine as redox probing species. This method investigates the outer sphere kinetic properties of the immobilized thin films and their interaction with the redox probe in solution. The charge-transfer resistance (R_{CT}) properties followed this trend of SPAuE modified surfaces with: PA > PA-MnTAPc > PA-CoTAPc > PA-SWCNT > PA-SWCNT-CoTAPc > PA-SWCNT-MnTAPc. The lowest R_{CT} values were obtained for PA-SWCNT-MTAPc as a good electron conducting modified surfaces better than other modified surfaces. The apparent electron-transfer rate constant (k_{app}) also confirmed that PA-SWCNT-CoTAPc and PA-SWCNT-MnTAPc were good electron conductors with the latter exhibiting highest k_{app} values highest of all the investigated electrodes. Figure 1 shows (a) the relationship between the charge-transfer resistance and the apparent electron-transfer ad (b) calibration curves with high sensitivity for conjugates towards H_{2}O_{2} electrocatalysis. The surface properties the formed thin films and their electrocatalytic applications towards the detection of hydrogen peroxide will be discussed.

Figure 1: (a) Relationship between the charge-transfer resistance and the apparent electron-transfer ad (b) calibration curves with high sensitivity for conjugates towards H_{2}O_{2} electrocatalysis.