11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Electrochemical characterization of electroactive nanocomposites containing cashew gum (*Anacardium occidentale L*) and modified polyaniline

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Abstract – We investigate the electroactivity of LbL fims containing polyaniline (PANI) or polyaniline modified with organic acidic phosphonate (AP), (PANI-AP), as cationic solutions, assembled with cashew gum (CG) or poly(vinylsulfonic acid) (PVS), as anionic solutions. The cashew gum improved the stability of PANI-AP films, allowing their use in the electrochemical detection of dopamine (DA).

The layer-by-layer (LbL) technique has been employed in the fabrication of nanostructured thin films upon immobilization of natural gums in conjunction with conducting polymers as modified electrodes for electrochemical applications [1]. The cashew gum (*Anacardium occidentale L.*), abundant in the Northeast of Brazil, is a heteropolysaccharide, high molecular weight biopolymer, which has been traditionally explored in industrial applications as emulsifiers and thickeners. In this paper, cyclic voltammetry was used to study the electrochemical properties of LbL films containing polyaniline (PANI) or polyaniline modified with organic acidic phosphonate (AP), (PANI-AP), as polycationic solutions assembled with anionic solutions, viz., cashew gum (CG) or poly(vinylsulfonic acid) (PVS). AP was synthesized as described by Geng et al [2]. The PANI or PANI-AP containing films were adsorbed onto glass covered with indium tin oxide (ITO) substrates in a bilayer fashion. Experiments were carried out in HCl 0.1 mol L^{-1} solution at room temperature.

Four distinct systems were investigated: PANI/PVS, PANI-AP/PVS, PANI/CG and PANI-AP/CG. The electroactive and electrochromic properties of PANI were not affected by their interaction with CG, PVS or AP dopant (Fig. A). An oxidation process, observed at 0.86 V *vs.* SCE, was related to the interaction of PANI or PANI-AP with PVS in LbL systems, as seen on Fig A1 and A2. LbL films using AP dopant showed higher current densities in comparison with films without dopant, as shown in Figs. A1 and A3. The presence of cashew gum improved the stability in films assembled with modified polyaniline (PANI-AP/CG), as revealed upon performing 20 successive cycles in acid media. In the presence of DA, PANI-AP/CG LbL films showed additional redox peaks at 0.63 and 0.29 V *vs.* SCE (Fig. B).

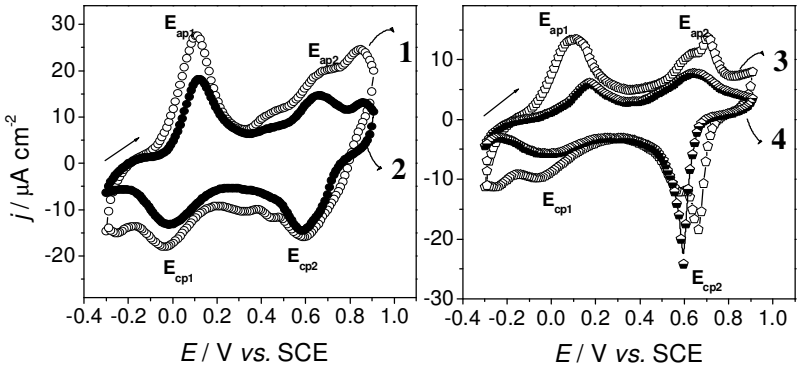

Figure A: Cyclic voltammograms for a 6-bilayer LbL films from **(1)** PANI-AP/PVS, **(2)** PANI/PVS, **(3)** PANI-AP/CG and **(4)** PANI/CG in 0.1 mol L^{-1} HCl solution. Scan rate: 50 mV s^{-1}.

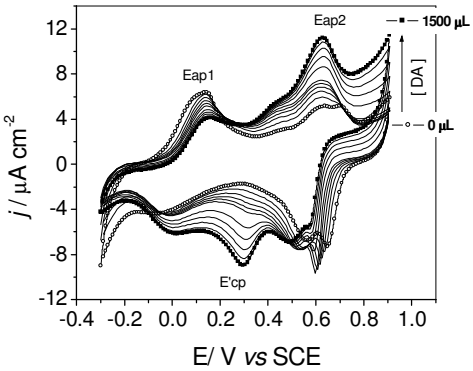

Figure B: Cyclic voltammograms for a 6-bilayer LbL film from PANI-AP/CG in 0.1 mol L^{-1} HCl solution in the presence of different concentrations of DA.

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Acknowledgments: The authors thank CAPES, FAPEPI, CNPq, and IMMP/MCT for financial support. Technical support from LAPETRO is also acknowledged.