A SOLID POLYMERIC ELECTROCHROMIC DEVICE

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An electrochromic device is a structure capable of reversibly changing optical properties under the influence of a small electric field. In one charge state the electrochromic film has an opaque color that can limit visible and/or infrared light. The other charge state is clear and transparent to similar wavelenghts[1]. In a previous work[2] we verified the improving of electrochemical properties of polyaniline composites. The present work reports a solid polymeric electrochromic device constituted by polyaniline-cellulose acetate composite / poly (dimetilsiloxano- co-ethylene oxide) / ITO glass.

The membranes were prepared from a solution containing 10 % wt. cellulose acetate (CA), 12 % of water and 78 % of acetic acid. This solution was spin coating on the ITO glass and it was coagulated by immersion in aqueous bath. The polymerization of PAni inside the porous of CA films/ITO was carried out in the potentiodynamic mode by cycling the potential from 0.10 to 0.80 V *vs.* Ag|AgCl. The electrolyte consisted of 1.0 mol.L^{-1} HCl and 1.0 mol.L^{-1} NaCl containing 0.1 mol.L^{-1} of distilled aniline.

As electrolyte we used poly (dimetilsiloxano- co-ethylene oxide) - P(DMS-*co*-EO)/$LiClO_4$. This complex was prepared by the mixture of the polymer and salt in THF. The solution was dried in vacuum for 48 h. The salt concentration was 5.0 % wt. $LiClO_4$. After drying the films, the PAni-CA / P(DMS-*co*-EO) / ITO system was assembled.

The DSC thermograms of polymer composite and CA membrane are shown in Figure 1. The composite exhibits three exothermic peaks related to the CA pyrolyses (325 and 435 ^oC) and PAni decomposition (386 ^oC)[3]. This fact evidence the composite formation.

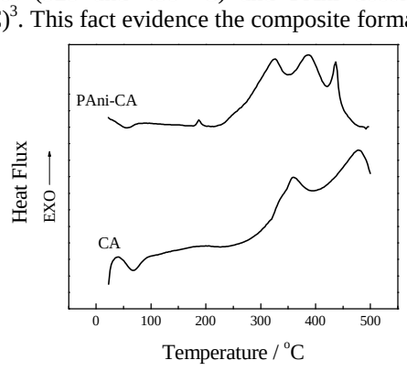

Fig. 1 – *Differential scanning calorimetry, at a heating rate of 10 $^oC.min^{-1}$.*

The electrochromic behavior of the system is strongly related to redox process of polyaniline described in the cyclic voltammetry (Fig. 2). The coloring process occur during polymer oxidation (E_{peak} = 1.2 V) and, in the other way, the bleaching process happens in the reduction (E_{peak} = -1.7 V). The absorptance increases monotonically when the potential applied changes from –1.7 to 1.2 V, Figures 3.

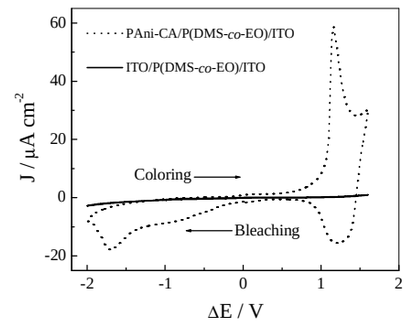

Fig. 2 – *Steady state cyclic voltammogram; at 5 mV.s^{-1}.*

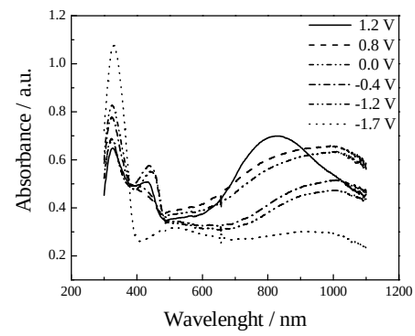

Fig. 3 – *UV-Visible spectra as a function of applied potential.*

The transmittance of the system during the chronoamperometric experiments are shown in Figure 4. As it can be seen in this figure, the higher contrast appear in the spectra range from 750 to 1050 nm, corresponding to near infrared.

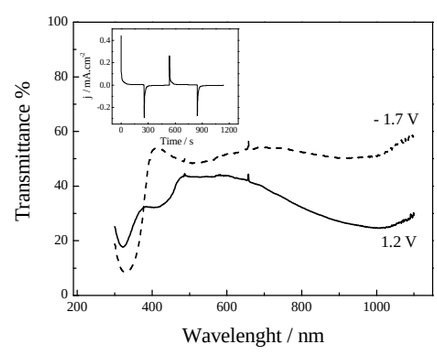

Fig. 4 – *Transmittance spectra of the PAni-CA / P(DMS-co-EO) / ITO system polarized at -1.7 (reduced state) and 1.2 V (oxidized state of PAni).*

The preliminary electrochromic evaluation of PAni-CA / P(DMS-co-EO) / ITO system has indicated good overall response. The investigation will be carried out to optimize the electrochromic conditions.

Acknowledgements

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