

Poly-3-Methylpyrrole: Electrochemical, Spectroscopic and Morphological Study.

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Poly-3-Methylpyrrole (p-3MPy) has been electropolymerized in acetonitrile with NaClO_4 as dopant at two constant overpotential values: $\eta_p = 0.3$ (Fig.1a) and 0.4 V (Fig.1b) vs Ag/Ag^+ . $[\text{3-Mpy}] = 3.8 \cdot 10^{-2}$ M and $[\text{NaClO}_4] = 5 \cdot 10^{-2}$ M in both cases.

As it is known the η_p value has also a great influence in the polymerization process of this polymer, as is shown in Fig. 1. $T_p = 300$ s.

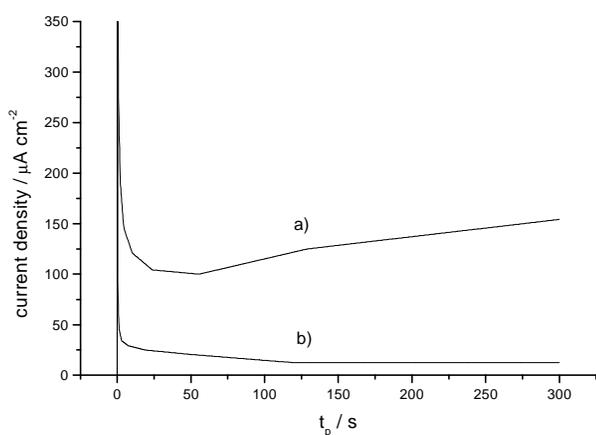


Figure 1

At $\eta_p = 0.4$ V the $j - t$ transient shows the steps related to the nucleation and growth of the polymeric phase, while at $\eta_p = 0.3$ V after the jump due to the applied potential the current density tends to zero.

The former films were characterized by cyclic voltammetry. The relaxation processes related to the electroactivity of the polymer have been observed.

Logarithmic plots between the current density and the potential sweep for anodic and cathodic waves reveal that the doping process is controlled by diffusion, slope = 0.5, and the de-doping one tends to be a capacitive process, the slope is 0.8. Thus in this reduction process the mobility of the dopant is higher (1).

Relationships between $Q_{\text{ox}}/Q_{\text{red}}$ at all scan rates (5, 20, 30, 80, 100 and $120 \text{ mV} \cdot \text{s}^{-1}$) generally indicate that the doping process is predominant, except at $5 \text{ mV} \cdot \text{s}^{-1}$ in the first cycles recorded. In all cases, in the fifth cycles recorded the de-doping process is lightly predominant due to changes in its structure on cycling.

The morphological examinations of deposits obtained at 0.4 V with the same experimental conditions above-mentioned reveals a compact globular texture with some dendritic 3D growths.

The FTIR spectrum of p-3MPy film shows the big absorption characteristic of a conducting polymer between 1800 and 7000 cm^{-1} due to the “free carriers” absorption and the skeletal pyrrole ring and CH stretching and bending vibrations below 1800 cm^{-1} . Fig.2. shows the micro-FTIR spectrum obtained at 0.3 V in acetonitrile.

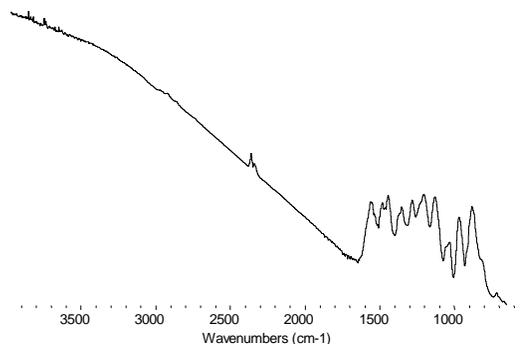


Figure 2.

(1) T. Schmidzu, A. Ohtani, T. Iyoda, K. Honda. J. Electroanal. Chem. **224** (1987) 123.