INFLUENCE OF THE SYNTHESIS METHOD ON THE MORPHOLOGICAL AND ELECTROCHEMICAL PROPERTIES OF PANI / CARBON FIBER COMPOSITE

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1. Introduction

Conducting polymers represent an interesting class of electrode materials for supercapacitors, due to their high kinetics of the electrochemical charge-discharge processes. Among them, polyaniline (PAni) has been the subject of intense research as flexible electrode for solid-state because of its, low cost, electrical conductivity, mechanical properties and high capacitance [1]. The charge is stored throughout the volume of the polymer material. Other material that has singular properties is the carbon fiber (CF) like large surface area, high conductivity, temperature stability and percolated pore structure. Hence, CF is an excellent substrate, which acts as a template for PAni synthesis. In this context, the aim of this work was to evaluate the influence of two different synthesis methods to obtain PAni on the CF substrate. Emphasis was given in the morphological and electrochemical properties of the PAni/CF composites obtained.

2. Experimental

PAni chemical synthesis was performed using CF (1x1 cm) fixed in a platinum wire and placed in reaction medium containing distilled aniline (12.6 mmol L^{-1}) and 1.0 mol L^{-1} HCl, 3.0 mol L^{-1} NaCl. Then, the oxidizing agent solution (ammonium persulfate) was slowly dripped in the reaction medium, with 30 min of the deposition times at -10 ºC with vigorous stirring. For electrochemical synthesis, the PAni was electrodeposited on CF electrode under galvanostatic mode using 5 mA cm^2 current density for 10 min in 0.5 mol L^{-1} H_2SO_4 aqueous containing 0.1 mol L^{-1} aniline. It was denominated PAni/CF_C the composite obtained for chemical synthesis and PAni /CF_E for prepared by the electrochemical synthesis.

3. Results and Discussions

The SEM images (Fig. 1(a) and (b)) showed heterogeneous PAni layer with small sponge-like agglomerates in the PAni/CF_C, while the PAni/CF_E presented homogeneous PAni layer. The cyclic voltammetry (CV) curves were carried out from −0.2 to 0.8 V at scan rate 25 mV s^{-1}. It was observed a pair of peaks well defined, which are attributed to the transition between leucoesmeraldina and emeraldine phase, besides a capacitive profile for both composites obtained. Based on the initial observations, both electrodes have potential of charge storage. However, the electrochemical synthesis appear as an interesting route to PAni/CF production because it spends less time, with a lower cost not to mention the minimum sludge. In this preliminary study, the electrochemical synthesis was the most suitable, but a more careful analysis will be required to test the efficiency of these electrodes, whose purpose will be to test them on devices energy storage.

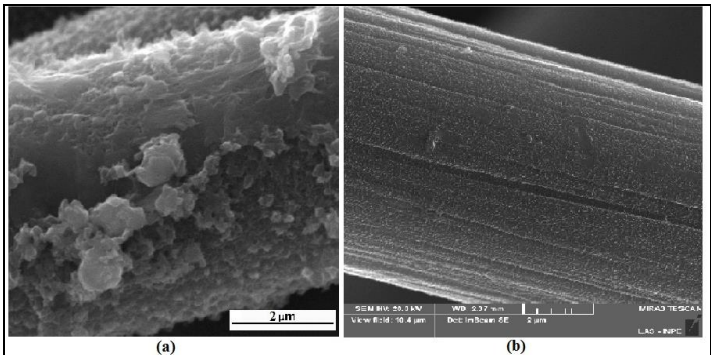

Fig. 1. *PAni/CF images: (a) PAni/CF_C obtained for chemical synthesis and (b) PAni/CF_E by electrochemical synthesis*

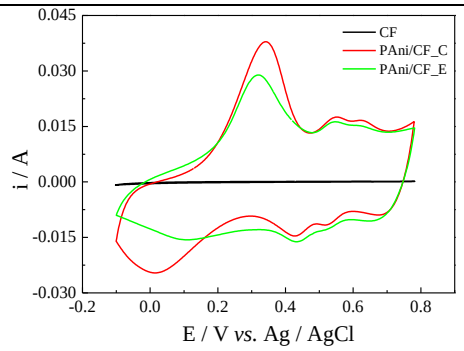

Fig. 2. *CV curves of PAni/CF obtained by both methods at a scan rate 25 mV s^{-1}.*

4. Reference

[1] P. Zhang et al., Electrochim. Acta, **184**, 1-7, (2015).

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