P3MT/VACNT/Al Nanocomposites Electrodes With High Capacitance For Supercapacitor

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Supercapacitors are desirable for applications requiring high power densities. Among the various types of supercapacitors, electrochemical ones based on electronically conducting polymers (ECP) as electrode material are particularly interesting because of their high capacitance (1). However, their energy densities and their electrochemical stability are still limited (2,3). In order to improve the capacitance and the energy density of such pseudo-capacitive supercapacitors, our strategy consists in making nanocomposite electrodes of poly-3-methylthiophene (P3MT) in ionic liquid media. These depositions were made on the surface of nanostructured electrodes composed of very dense carpet of vertically aligned carbon nanotubes (10^{11} – 10^{12} CNT/cm²) on an aluminium collector (VACNT/Al). In this study, different electropolymerizations methods (cyclic voltammetry, galvanostatic, potentiostatic, pulsed methods (3,4)) were used to optimized the deposition and the storage properties of P3MT. Thus, nanocomposites with weight ratios of P3MT/(P3MT+CNT) ranging from 5 to 90% were obtained and characterized by electrochemistry (CV and EIS) and microscopy. The results show that conformal depositions of polymers were obtained. In the case of the best nanocomposites, the electrodes capacitance increase from 32 mF/cm² to 1300 mF/cm². Finally, stability tests of electrodes and coin cells assembly were studied and their performances will be presented.

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