Influence of Applied Potential on the Conductivity of Polypyrrole Thin Films growing on Indium Tin Oxide

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Abstract : As one of the promising conducting polymers (CPs), polypyrrole (PPy) has been extensively used as active electrode material for many applications: anti-corrosive coatings, batteries, electronic devices, sensors and biomaterials. In fact, PPy is a widely studied conductive polymer due to its high environmental, thermal and chemical stability, their good electronic conductivity and ease of synthesis. Its conductivity originates from the ? electrons delocalized over the conjugated system and from the doping ions. PPy thin films can be synthesized on electrodes from organic or aqueous media by chemical and electrochemical methods. Electrochemical deposition offers a versatile and facile method since the film formation and its properties (thickness and surface topography) can be easily controlled by controlling the electropolymerization conditions, such as applied potential, current density, monomer concentration, electrolyte solutions and pH. Recently, it has been reported that properties of PPy films depend significantly on their final morphology. Therefore, synthesis of novel morphologies of PPy deposits could improve some of these properties. In this study, PPy thin films were deposited on indium tin oxide (ITO) electrode under potentiostatic control from a solution containing 0.01 M pyrrole (C4H5N) dissolved in acetonitrile (CH3CN). The influence of the applied anodic potential on the morphology, electrochemical behavior, as well as the electronic conductivity of the resulting PPy films was investigated. For this purpose, PPy films deposition was performed at three applied potentials 0.8, 1 and 1.1 V/SCE for 2 min. The obtained films were characterized by impedance spectroscopy measurements, scanning electron microscopy (SEM), and atomic force microscopy (AFM).

Keywords : Chronoamperometry, Electrochemical polymerization, Polypyrrole, Thin films