

COMPARATIVE MORPHOSTRUCTURAL AND ELECTROCHEMICAL
CHARACTERIZATION OF POROUS Ti/SnO₂ CORRELATED WITH THE
SYNTHESIS METHOD

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Abstract

In the recent years, one of the most important reasons for water pollution is the massive discharge of organics pollutants in water, which is characterized by high organic load and complex characteristics [1]. Electrochemical advanced oxidation processes (EAOP) for the wastewater treatment is attractive due to its simplicity, low energy consumption and environmental friendliness, but the central element is represented by the electrode correlated with the electrochemical reactor configuration. The promising electrode must fulfill four requirements including long lifetime, high catalytic activity, low cost and no secondary pollution. Much attention has been focused on dimensional stable anodes (DSAs) due to the advantages of high electric catalytic activity, low cost, simple preparation method [2]. DSAs exhibit high electroactive areas due to their mud-cracked morphology, allowing the direct oxidation of organic pollutants on the electrode surface at low potentials and are able to promote the formation of active intermediates ($\cdot\text{OH}$, Cl^\cdot) to perform the indirect oxidation of pollutants [3]. DSAs electrodes consist of a titanium substrate covered with an oxide coating, whose composition strongly affects their electrochemical behavior. Considering the main mechanistic aspects related to the reactant and product transport to and from the electrode surface and the electron transfer, as stages of the overall electrode process, so-called three-dimensional stable anodes (3-DSAs) characterized by large porosity should exhibit enhanced electrooxidation activity towards the organic pollutants through improvement of the transport stage rate.

This paper presents a comparative study of two methods, *Dr. Blade* and *spin-coating* protocols, for synthesis of porous Ti/SnO₂ dimensionally stable anode suitable for advanced treatment of water/wastewater. The morphological differences of SnO₂ films appeared because of the type of SnO₂ specific to each synthesis method. Thus, it was used a crystalline powder into polymer matrix of SnO₂ for *Dr. Blade* method, and the amorphous gel of SnO₂ for *spin-coating* method. The morpho-structural characterization through X-ray diffraction (XRD) and scanning electron microscope coupled with energy-dispersive X-ray (SEM/EDX) confirmed a uniform and compact deposition of SnO₂ on Ti surface with typical "mud-cracked" like structure, for both synthesis methods. However, more porous structure of SnO₂ was noticed for *Dr. Blade* method in comparison with *spin-coating* that led to a more compact film of SnO₂. Electrochemical behaviours of both electrodes were studied by cyclic voltammetry in 0.1 M Na₂SO₄ and respective, in 0.05 M Na₂SO₄ and 0.05 M NaCl and in the presence of 5 mg·L⁻¹ Doxorubicine (DRC), a cytostatic from emerging pollutants class from water.

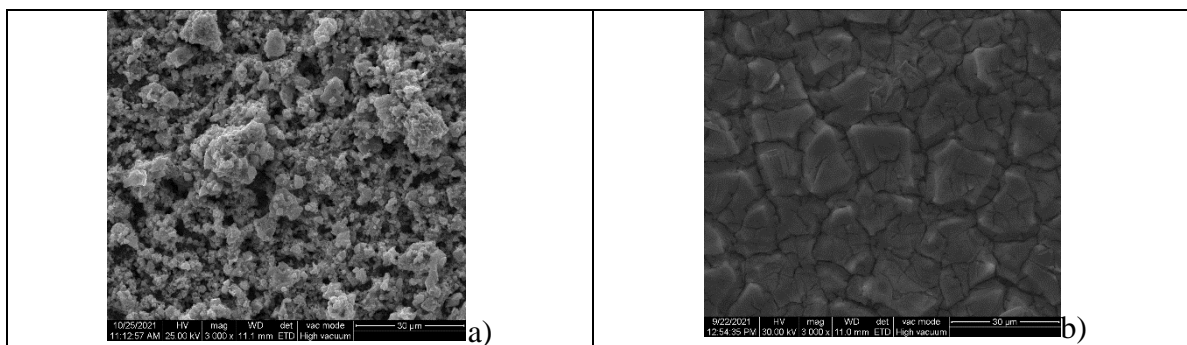


Fig.1. SEM image for a) Ti/SnO₂-Dr Blade deposition and b) Ti/SnO₂ spin-coating method

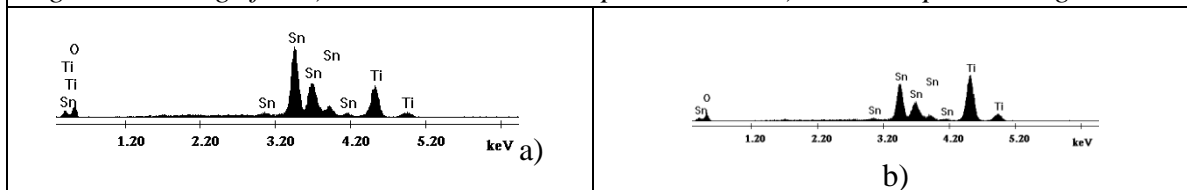


Fig.2. EDX spectra for a) Ti/SnO₂-Dr Blade deposition and b) Ti/SnO₂ spin-coating method

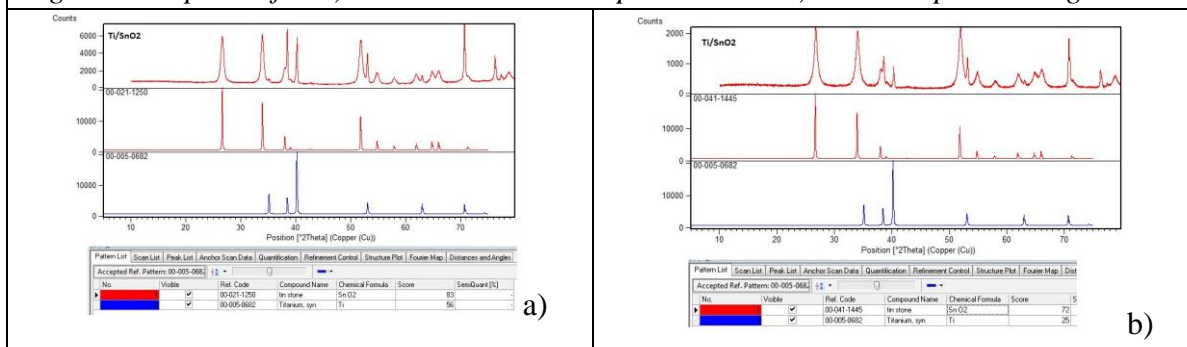


Fig.3. XRD diffraction of a) Ti/SnO₂-Dr Blade deposition and b) Ti/SnO₂ spin-coating method

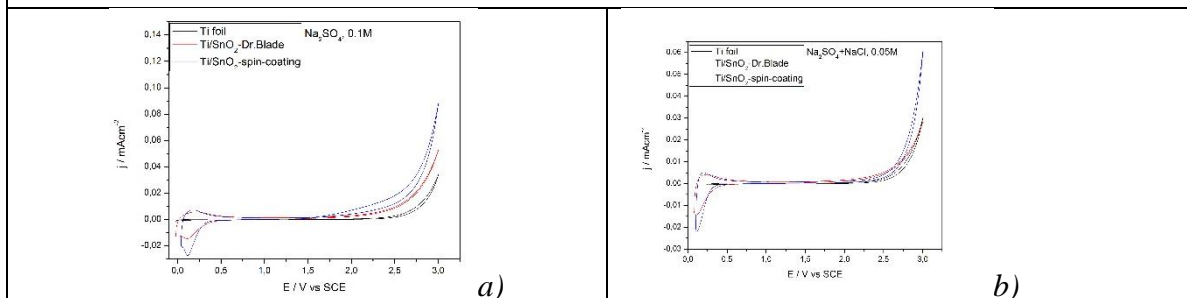


Fig.4. Comparative cyclic voltammograms recorded in 5 mg·L⁻¹ DRC with both electrodes at 0.05 V·s⁻¹ in the supporting electrolytes: a) 0.1 M Na₂SO₄ and b) 0.05 M Na₂SO₄ and 0.05 M NaCl

Acknowledgements

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