Nanostructured transition metal oxides produced by electrodeposition for application as redox electrodes for supercapacitors

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1. ABSTRACT

The increasing demand for energy and the need of cleaner production technologies has turned energy storage into a hot research topic. Development of more efficient energy storage devices, such as batteries and supercapacitors, is the key to boost renewable energy production and the use of electric/hybrid vehicles. Electrochemistry is one of the sciences behind these challenging technologies. The performance of these devices relies on the nature of the electrodes they use. 2D and 3D nanostructured architectures composed of transition metal oxides, or its composites with carbon, have recently emerged as promising electrode materials for supercapacitors due to their pseudocapacitive contribution and high theoretical capacitances.

For application in supercapacitors, the electrodes must present high porosity and surface area. These are necessary properties to enhance charge transfer and redox reactions at the film/electrolyte interface. One of the most promising techniques to produce transition metal films with such characteristics is electrodeposition because of its versatility and easy-to-do. Electrodeposition is a widespread cheap and clean one-step technique for the fabrication of metals, metal oxides, polymers and composite coatings. By combining optimized deposition parameters with the required electrolyte composition, the morphology and the chemical composition of the deposited film can be tailored to achieve nanostructured architectures.

In this chapter, recent advances in 2D and 3D nanostructured architectures of transition metal oxide films produced by electrodeposition and their application as electrodes for electrochemical pseudo supercapacitors, including their electrochemical performance are reviewed and recent trends and results are highlighted.

Keywords: Supercapacitors, Electrodeposition, transition metal oxides