

SnO₂/ZnWO₄ nanocomposite for supercapacitor application

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Abstract: Portable energy devices are the future of power sources. With the advent of electric cars and portable electronic devices, the need for energy storage devices capable of delivering higher power for a longer time is higher than ever. Supercapacitors and Li-ion batteries are believed to be the future energy storage devices that could meet such high demands. For devices that require higher power, supercapacitors are the solution. Having a fair concern for the environment, it is essential for these devices to be environment friendly, powerful and efficient. One way to achieve this is by developing the electrode materials. Microstructure of the electrode and interaction of the electrode with the transport ion plays a key role in determining the capacity of an energy storage device. Over the years, extensive research resulted in providing various kinds of materials for supercapacitor application. One such material is the Transition Metal Oxide. Transition Metal Oxides can be grouped into three types. (i) Single Metal Oxides (SnO₂, NiO₂, CuO₂), (ii) Binary Metal Oxides (ZnWO₄, MnWO₄) and (iii) Hybrid Metal Oxides (Ni(OH)₂/MnO₂, NiWO₄/Co₃O₄). Hybrid metal oxides are synthesized due to their high electrical conductivity and various oxidization states [1]. There are various methods are used to prepare pseudocapacitive oxides such as hydrothermal, solution phase synthesis and electrode deposition methods. Hydrothermal method is widely used synthesis method to produce a highly pure phase and desired morphology [2].

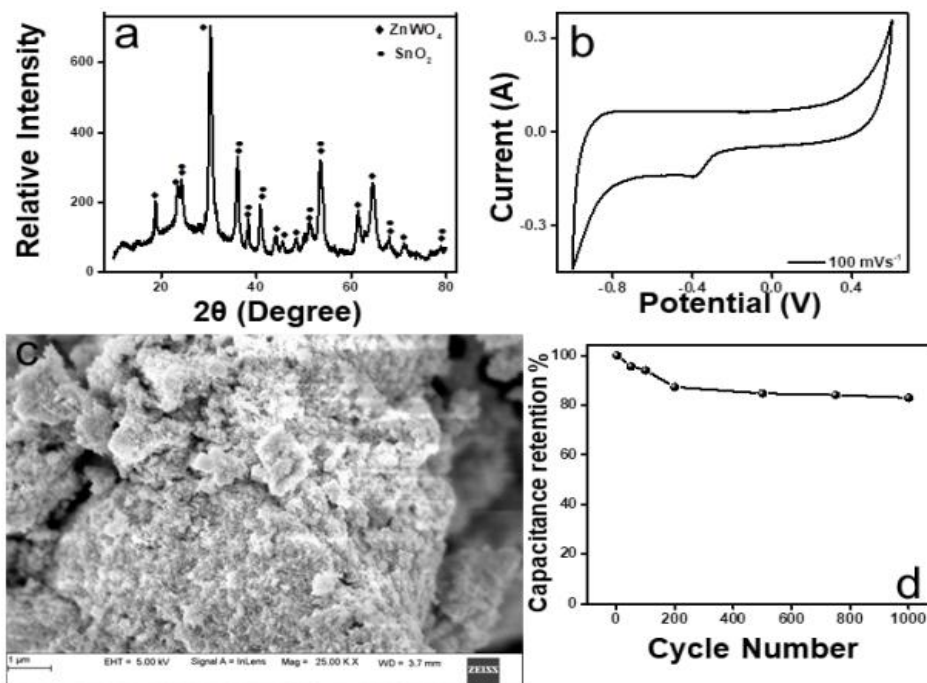


Figure 1(a) XRD pattern of the SnO₂/ZnWO₄ nanocomposite. (b) Cyclic Voltammetry at 100 mV/s scan rate (c) FESEM image of the SnO₂/ZnWO₄ nanocomposite (d) capacity retention plot.

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Herein, we prepared a SnO₂/ZnWO₄ nanocomposite by single step Solvothermal method. The prepared hybrid metal oxide is used as an electrode material for the supercapacitor application. The electrochemical tests were performed using a three electrode system of Biologic SP-150 electrochemical workstation. The prepared SnO₂/ZnWO₄ nanocomposite is coated on the titanium foil (1 × 1 cm²) and used as a working electrode, Ag/AgCl as reference electrode and platinum wire as counter electrode. To find out the electrochemical property of the SnO₂/ZnWO₄ nanocomposite Cyclic Voltammetry (CV), Galvanostatic Charge-Discharge (GCD) and Electrochemical Impedance Spectroscopy (EIS) in 2 M KOH aqueous electrolyte was carried out. SnO₂/ZnWO₄ nanocomposite deliver 56.7 F/g capacity at 1 mV/s scan rate. To our best knowledge there is no report on SnO₂/ZnWO₄ nanocomposite as an electrode material for supercapacitor

References:

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- [2] K. Bindu, K. M. Ajith, H. S. Nagaraja, Influence of cations on the dielectric properties of spinel structured nanoferrites, Materials Research Express, 6 (2019) 045011.