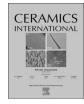


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High performance MnO₂ nanoflower supercapacitor electrode by electrochemical recycling of spent batteries



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ARTICLE INFO

Keywords: Spent batteries Supercapacitance Electrochemical conversion MnO₂ nanoflower

ABSTRACT

 MnO_2 nanoflower is prepared by electrochemical conversion of Mn_3O_4 obtained by heat treatment of spent zinc-carbon batteries cathode powder. The heat treated and converted powders were characterized by TGA, XRD, FTIR, FESEM and TEM techniques. XRD analyses show formation of Mn_3O_4 and MnO_2 phases for the heat treated and converted powders, respectively. FESEM images indicate the formation of porous nanoflower structure of MnO_2 , while, condensed aggregated particles are obtained for Mn_3O_4 . The energy band gap of MnO_2 is obtained from UV–Vis spectra to be 2.4 eV. The electrochemical properties are investigated using cyclic voltammetry, galvanostatic charge–discharge and electrochemical impedance techniques using three-electrode system. The specific capacitance of MnO_2 nanoflower (309 F g⁻¹ at 0.1 A g⁻¹) is around six times higher than those obtained from the heat treated one (54 F g⁻¹ at 0.1 A g⁻¹). Moreover, it has high capacitance retention up to 93% over 1650 cycles. Impedance spectra of MnO_2 nanoflower show very small resistances and high electrochemical active surface area (340 m² g⁻¹). The present work demonstrates a novel electrochemical approach to recycle spent zinc-carbon batteries into high value supercapacitor electrode.

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http://dx.doi.org/10.1016/j.ceramint.2017.03.195

Received 1 February 2017; Received in revised form 12 March 2017; Accepted 30 March 2017 Available online 31 March 2017 0272-8842/ © 2017 Elsevier Ltd and Techna Group S.r.l. All rights reserved.