Sonochemical synthesis of mesoporous MnO_2 for Zinc-Air battery applications

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Abstract

MnO_2 is one of the candidate materials for the application to electrochemical capacitors, Li-ion batteries, sensors and catalysts [1]. In energy-storage devices, nano structured MnO_2 has been used as an active material because of its low cost and natural abundance as well as it being environmentally safe [2]. Sonochemical technique has proved to be useful method for generating nano structures of oxide materials with highly pure and unusual properties in short reaction times [3].

Here in, nanostructured MnO_2 was synthesized using a simple one-step sonochemical method in the presence of poly (ethylene glycol)-block poly (propylene glycol)-block-poly (ethylene glycol) (P123) as a soft template as well as a reducing agent. Prepared samples have been characterized using X-ray diffraction (XRD), morphology of the samples has been characterized by field-emission scanning electron microscopy (FESEM). The pore structures of the prepared samples were tested by N_2 adsorption-desorption measurements. The activity and stability of this catalyst was evaluated by preparing air electrodes with primary Zinc−Air batteries that consume ambient air.

The XRD results indicated that MnO_2 sample was poorly crystalline. The FESEM images showed that the nanostructure of MnO_2 was composed. The size of nanoparticles were about 10-13 nm. A BET surface area of 87 m^2/g is achieved for mesoporous MnO_2 sample. The results of electrochemical tests revealed that the peak power density of Zinc-Air batteries were 136.05 mW/cm^2. The cells galvanostatic discharge showed maximum discharge current density of 200 mA/cm^2.

Keywords: *MnO_2 nanostructure, Sonochemical synthesis, Zinc-Air battery.*

Reference

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