8th Iranian Annual Seminar of Electrochemistry

30-31 January 2013

Faculty of Chemistry, University of Mazandaran, Babolsar, Iran

A new electro catalyst for oxygen reduction reaction and its application as Zn-Air battery cathode

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Abstract

The fundamental processes in many environmentally related fields are oxygen reduction and evolution such as H_2/O_2, direct methanol fuel cells, rechargeable metal-air and metal hydride–air batteries, water electrolysis and chloro alkali cells. The mixed valence oxides of Co, Ni and Mn with a spinel and perouskite crystal structure have potential application to oxygen reactions. In this work Ni_6MnO_8 was synthesized, characterized and its electrochemical behavior was investigated.

The catalyst was synthesized by co-precipitation method. Phase and morphology of synthesized material were studied by XRD and SEM analyses. The gas diffusion electrode (GDE) was prepared by as-synthesized material. The electrochemical behavior was studied by linear sweep voltammetry (LSV), electrochemical impedance spectroscopy (EIS) in a tree electrode configuration. The Ni_6MnO_8 GDE was tested in single Zn-Air cell with respect to the oxygen reduction reaction at different discharge currents.

The XRD results showed that the cubic Ni_6MnO_8 was formed without any impurity. The Ni6MnO8 nano particles was observed by SEM images. The LSV results revealed that oxygen reduction reaction (ORR) was done in the smaller over potential than graphite electrode. The current density of GDE contain Ni6MnO8 at 800 mV (vs. Ag/AgCl) increased more than 15 times compare that graphite GDE. The EIS displayed that charge transfer resistance for ORR was reduced in the presence of Ni_6MnO_8. Chronopotentiometry results showed that Ni_6MnO_8 can be used as cathode electro catalysts in Zn-air batteries.

Keywords
Electrocatalyst, Oxygen Reduction Reaction, Zn-Air battery.

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