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Electrochemically induced spinel-layered phase transition of Mn_3O_4 in high performance neutral aqueous rechargeable zinc battery

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Abstract

Mn_3O_4 is an electrochemically inactive in alkaline Zn-MnO_2 battery. Here, we show that Mn_3O_4 shows superior electrochemical performance in mild aqueous zinc sulfate electrolytes. Mn_3O_4 can be a new cathode material for neutral aqueous rechargeable zinc battery. Results reveal that spinel Mn_3O_4 transforms to intermediate Mn_5O_8 and finally to Zn-birnessite. The initial charge cycle proceeds without participation of zinc ions, while zinc ions participate in the subsequent reaction. The intercalation of zinc ions into the interlamination of birnessite leads to the generation of Zn-birnessite in discharge process, accompanied by the reduction of Mn^{4+} to Mn^{3+}. Our results demonstrate a new manganese oxide cathode with average Mn valence state lower than four for rechargeable zinc batteries.

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