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Abstracts presented in the original edition

THE EFFECT OF ELECTROLYTE ON THE $LiMn_2O_4$ PERFORMANCE IN HYBRID Zn/Li AQUEOUS BATTERY

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Lithium manganese spinel $LiMn_2O_4$ (LMO) is a well-known cathode material for lithium-ion batteries due to its low cost, environmentally friendliness and high voltage (near 4.1 V vs. Li/Li^+). Furthermore, this material was applied for aqueous batteries and supercapacitors. Among them, hybrid zinc-lithium (Zn/Li) aqueous rechargeable batteries have attracted a great attention owing to low oxidation potential of zinc (-0.76 V vs. H_2/H^+), high abundance and nontoxicity.

Nevertheless, the main drawbacks of LMO are poor electronic conductivity and manganese dissolution during charge/discharge processes which leads to moderate capacity fading during long-term cycling. The most commonly used approach to eliminate these drawbacks is modification of electrolyte composition. It was demonstrated that addition of indifferent salts like ammonium chloride [1] or development of high-concentrated electrolytes ("water-in-salt") [2] allows stabilizing electrochemical characteristics of LMO-based cathode materials because of increasing the ionic conductivity and preventing gas evolution reactions. For other manganese-based cathodes for zinc aqueous batteries manganese (II) salt can be added to increase stability during long cycling [3] due to decrease of Mn^{IV} dissolving.

In our work, a detailed investigation of electrochemical performance of LMO as cathode material for hybrid Zn/Li batteries was performed with three types of aqueous sulfate electrolytes: pure zinc sulfate, mixture of zinc and lithium sulfates and three-component electrolyte $ZnSO_4$ / Li_2SO_4 / $MnSO_4$. Electrodes were prepared in accordance with conventional technique and tested vs. zinc foil by cyclic voltammetry and galvanostatic charge/discharge.

We demonstrated that application of sulfate-based two-component electrolytes allows achieving a remarkable capacity values at moderate (1 C) and high (5 C) current densities (120 and 90 $mAh \cdot g^{-1}$, respectively). Addition of manganese sulfate leads to increasing the capacity at current density 1 C. The morphology and phase composition of electrodes were analyzed by X-ray diffraction and energy dispersive X-ray analysis.

References

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