COIN2022

CONTEMPORARY BATTERIES AND SUPERCAPACITORS

INTERNATIONAL SYMPOSIUM BELGRADE 2022

PROGRAM AND BOOK OF ABSTRACTS

June 1-2, 2022,
Serbian Academy of Sciences and Arts
Belgrade, Serbia

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- Metal-air batteries
- Multivalent charge storage systems
- Materials for energy storage and conversion

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A Comparison of the Capacities of $ZnMn_2O_4$ and $ZnCr_{0.15}Mn_{1.85}O_4$ in Aqueous Media

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To protect the environment from potentially hazardous components from commercial Li-ion batteries (i.e., contain toxic and flammable electrolytes as well as Li is uneconomical and a rare earth metal), a viable alternative need to be found for the components of these batteries. Thus, our focus is on replacement of an organic electrolyte using an aqueous one. Additionally, the work also examines the replacement of Li with Zn as production of Zn-based cathode material is more economical compared to Li and less toxic. Due to occurrence of the Ian Teller effect in $ZnMn_2O_4$, Mn^{3+} ions are partially replaced with Cr^{3+} ions to diminish this phenomenon and to obtain a higher capacity. Namely, due to the Ian-Teller distortion, not all cations of Zn^{2+} ions may intercalate in the crystal lattice sites. When the Ian-Teller effect lowers, more Zn^{2+} ions may intercalate into sites; thus, a higher capacity may be obtained. The materials $ZnMn_2O_4$ and $ZnCr_{0.15}Mn_{1.85}O_4$ were synthesized by glycine nitrate combustion method. The materials were characterized by XRPD, SEM, EDS and cyclic voltammetry. The aqueous solutions of $ZnCl_2$ were used as electrolytes as potentially more ecological alternatives compared to the organic ones already commercially used. The cathode capacities obtained for the $ZnMn_2O_4$ under 5 mV s^{-1} and 20 mV s^{-1} ranged from 17.7 mA h g^{-1} to 6.9 mA h g^{-1}. The cathode capacities obtained for $ZnCr_{0.15}Mn_{1.85}O_4$ under 5mV s^{-1} and 20 mV s^{-1} ranged from 86.3 mA h g^{-1} and 24.6 mA h g^{-1}, respectively. Over the intercalation and deintercalation process of the Zn^{2+} ions into the $ZnCr_{0.15}Mn_{1.85}O_4$, a release of oxygen occurred. The stable capacity obtained for both rates (5 mV s^{-1} and 20 mV s^{-1}) indicates that the $ZnCr_{0.15}Mn_{1.85}O_4$ material is applicable for both rates used. Further examination of the $ZnMn_2O_4$ material must be conducted in terms of increasing the capacity through its doping with other ions or its use in an aqueous solution of other salts.

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