The Serbian Society for Ceramic Materials
Institute for Multidisciplinary Research (IMSI), University of Belgrade
Institute of Physics, University of Belgrade
Center of Excellence for the Synthesis, Processing and Characterization of Materials for use in Extreme Conditions "CEXTREME LAB" - Institute of Nuclear Sciences "Vinča", University of Belgrade
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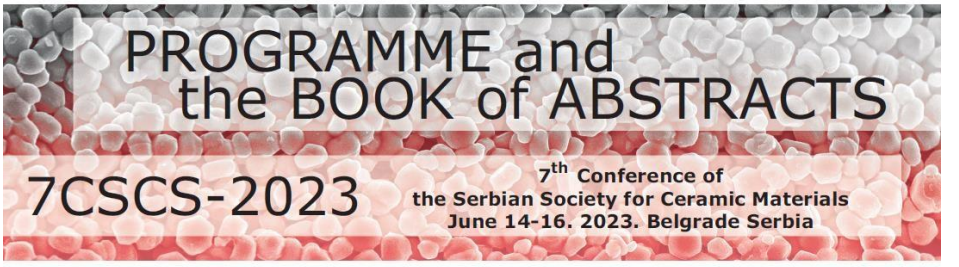

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SPECIAL THANKS TO

Република Србија
МИНИСТАРСТВО НАУКЕ,
ТЕХНОЛОШКОГ РАЗВОЈА И ИНОВАЦИЈА

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$ZnMn_2O_4$ AS A CATHODE MATERIAL IN AN AQUEOUS SOLUTION OF $ZnCl_2$ AND $Mn(NO_3)_2$ FOR Zn-ION BATTERIES

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Due to Li-ion batteries having become the main power source of most portable electronic devices, their waste has also become a significant environmental problem. To find batteries that would be environmentally friendly, this work examines Zn-ion batteries in an aqueous solution of $ZnCl_2$. The $ZnMnO_4$ was synthesized by glycine nitrate combustion of $Zn(NO_3)_2$, $Mn(NO_3)_2$ and glycine as a chelating agent [1]. The structure of the material obtained was characterized by X-ray powder diffraction (XRPD) showing a spinel structure; the morphology was characterized by scanning electron microscopy (SEM) showing that nano-particles were obtained. The electrochemical characterization was done by cyclic voltammetry in an aqueous solution of $ZnCl_2$. The mixture pasted on the glossy carbon electrode was prepared by mixing the cathode material, graphite and polyvinyl diene difluoride (PVDF) in a ratio 85:10:5 [2]. Due to the low discharge capacity obtained of ~14 mAh g^{-1} for 5 mV s^{-1}, further examination was done by adding 1 ml of 1M $Mn(NO_3)_2$ into 10ml of a saturated aqueous solution of $ZnCl_2$. After adding the $Mn(NO_3)_2$, the discharge capacity increased from ~14 mAh g^{-1} to ~65 mAh g^{-1} at the same polarization rate, making this additive a promising one for aqueous Zn-ion batteries. Further investigation needs to be directed to adding the same additive in larger amounts compared to 1ml to the same volume of the electrolyte. The results obtained suggest the aqueous Zn-ion battery described in this work to be a potentially promising "green" battery that may replace harmful commercial organic Li-ion batteries.

1. J. Senćanski, *Russian J. Phys. Chem. A,* **96** (2022) 2783.
2. J. Senćanski, *J. Power Sources,* **342** (2017) 690.