MATERIALS RESEARCH SOCIETY OF SERBIA
INSTITUTE OF TECHNICAL SCIENCES OF SASA

Programme and the Book of Abstracts

NINETEENTH YOUNG RESEARCHERS' CONFERENCE MATERIALS SCIENCE AND ENGINEERING

Belgrade, December 1-3, 2021

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&
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Aim of the Conference

Main aim of the conference is to enable young researchers (post-graduate, master or doctoral student, or a PhD holder younger than 35) working in the field of materials science and engineering, to meet their colleagues and exchange experiences about their research.

Topics

Biomaterials
Environmental science
Materials for high-technology applications
Materials for new generation solar cells
Nanostructured materials
New synthesis and processing methods
Theoretical modelling of materials

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Results of the Conference

Beside printed «Program and the Book of Abstracts», which is disseminated to all conference participants, selected and awarded peer-reviewed papers will be published in journal "Tehnika – Novi Materijali". The best presented papers, suggested by Session Chairpersons and selected by Awards Committee, will be proclaimed at the Closing Ceremony. Part of the award is free-of-charge conference fee at YUCOMAT 2022.

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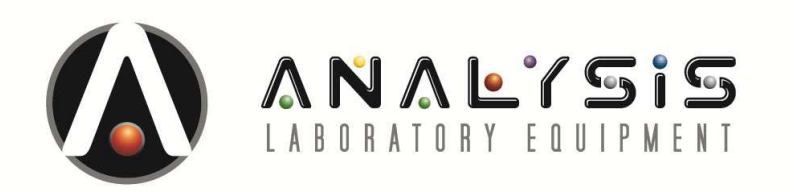

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Layered CaV_2O_6 as promising electrode material for multivalent storage

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While the world is facing a higher demand for lithium, its limited resources associated with the high price, are becoming problematic. Other crucial drawbacks of Li-ion batteries are their toxicity and safety concerns. Therefore, researchers are oriented towards development of non-Li batteries based on eco-friendly and earth-abundant materials to overcome drawbacks of Li-ion technology. Alternative abundant metals and their ions such as Mg and Ca could be a good choice for rechargeable batteries in terms of cost and eco-friendliness. Mg^{2+} and Ca^{2+} ions could transfer two electrons per redox process which theoretically has a positive effect on battery performance. The materials upon which multivalent ions will intercalate with fast diffusion rate are hard to find. Metal vanadium oxide ($M_xV_yO_z$) materials become promising materials for rechargeable batteries, so herein, a standard sol-gel combustion route was used for the preparation of the CaV_2O_6 layered precursor. Two samples are synthesized from the vanadate precursor, the first when it was heated at 400 °C (CaVO) and the second when CaVO was integrated with 10 wt % of sucrose under thermal treatment at 400 °C, in Ar atmosphere (CaVO/C). Obtained CaVO and CaVO/C powders were thoroughly characterized by XRD, TG-DTA, FTIR, and Raman spectroscopy. The electrochemical performance of the obtained samples was evaluated for multivalent-ion storage in saturated aqueous electrolytic solutions of Mg $(NO_3)_2$ and Ca $(NO_3)_2$ by cyclic voltammetry and chronopotentiometry. For comparison, measurements were also done in saturated $LiNO_3$. Results indicated that CaVO can store more Li^+ ions than Mg^{2+} and Ca^{2+} ions, but CaVO in $LiNO_3$ shows a substantial loss of capacity upon cycling, which is not observed in the case of Mg $(NO_3)_2$ and Ca $(NO_3)_2$. On the other hand, CaVO/C composite showed a significant improvement for Ca an Mg storage capacity, which exceeded capacity storage of Li^+ ions. The high and stable discharge capacity of CaVO/C, amounting to 89.3 mA h g^{-1} at 0.5 A g^{-1}, was obtained in Ca $(NO_3)_2$. Obtained results are promising and open novel directions regarding the use of CaV_2O_6 for multivalent rechargeable batteries, especially for Ca-ion batteries.

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