MATERIALS RESEARCH SOCIETY OF SERBIA
INSTITUTE OF TECHNICAL SCIENCES OF SASA

Programme and the Book of Abstracts

EIGHTEENTH YOUNG RESEARCHERS' CONFERENCE
MATERIALS SCIENCE AND ENGINEERING

Belgrade, December 4–6, 2019

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Book title:
Eighteenth Young Researchers' Conference - Materials Science and Engineering: Program and the Book of Abstracts

Publisher:
Institute of Technical Sciences of SASA
Knez Mihailova 35/IV, 11000 Belgrade, Serbia
Tel: +381-11-2636994, 2185263, http://www.itn.sanu.ac.rs

Editor:
Dr. Smilja Marković

Technical Editor:
Aleksandra Stojičić

Cover page: Aleksandra Stojičić and Milica Ševkušić
Cover: Modified Photo by Miloš Stošić; Wikimedia Commons (https://commons.wikimedia.org/wiki/File:Бедеми_-_поглед_на_Ушће.jpg); Creative Commons Attribution-Share Alike 3.0 Unported license

Printer:
Gama digital centar
Autoput No. 6, 11070 Belgrade, Serbia
Tel: +381-11-6306992, 6306962
http://www.gdc.rs

Edition:
130 copies

CIP - Каталогизација у публикацији

Народна библиотека Србије, Београд

66.017/.018(048)

YOUNG Researchers Conference Materials Sciences and Engineering (18 ; 2019 ; Beograd)
Program ; and the Book of abstracts / Eighteenth Young Researchers' Conference Materials Sciences and Engineering, December 4-6, 2019, Belgrade, Serbia ; [organized by] Materials Research Society of Serbia & Institute of Technical Sciences of SASA ; [editor Smilja Marković]. - Belgrade : Institute of Technical Sciences of SASA, 2019 (Belgrade : Gama digital centar). - XX, 102 str. : ilustr. ; 23 cm

Tiraž 130. - Registar.

ISBN 978-86-80321-35-6 (ITSSASA)

а) Наука о материјалима -- Апстракти б) Технички материјали – Апстракти

COBISS.SR-ID 281006348

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 2020.

Sponsors

Acknowledgement

The editor and the publisher of the Book of abstracts are grateful to the Ministry of Education, Sciences and Technological Development of the Republic of Serbia for its financial support of this book and The Eighteenth Young Researchers' Conference - Materials Sciences and Engineering, held in Belgrade, Serbia.

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Electrochemical oxidation of maricite $NaFePO_4$ in mild aqueous solutions as a way to boost its charge storage capacity

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Lithium has a low abundance in the Earth's crust, which in a few years will lead to difficult lithium production, and therefore difficult production of lithium-ion batteries. Sodium-ion batteries, on the other hand, have been proven to be a good replacement. The material obtained from iron combined with the phosphate and pyrophosphate compounds of sodium has attracted attention as a possible cathode material for sodium-ion batteries. $NaFePO_4$ exists in two polymorphic structures (triphylite and maricite). Maricite $NaFePO_4$ is a more thermodynamically stable structure than triphylite NaFePO4 but doesn't have channels for Na^+ movement and electrochemical performance of this structure is low. In comparison to maricite $NaFePO_4$, triphylite $NaFePO_4$ (structural analogue to $LiFePO_4$) has one-dimensional channels for Na^+-ions movement and better electrochemical activity but it is not stable and is difficult to synthesize. Herein, the maricite $NaFePO_4$ can be obtained by sintering a polyanionic compound, $Na_4Fe_3(PO_4)_2P_2O_7$, at temperatures above 600 °C, as shown by XRD. $Na_4Fe_3(PO_4)_2P_2O_7$ is synthesized by the glycine-nitrate process after which it was sintered at temperatures above 500 °C. The glycine-nitrate process was found to catalyze the decomposition of the sintered $Na_4Fe_3(PO_4)_2P_2O_7$ to the $NaFePO_4$ maricite. The electrochemical characterization of the sintered material, evaluated in aqueous $NaNO_3$ and $LiNO_3$ electrolyte by cyclic voltammetry, showed poor electrochemical activity of maricite $NaFePO_4$. By exposing the sintered material to high anodic potentials, the electrochemical activity and specific capacity of the material were increased by 50% in case of $NaNO_3$ and 80% in case of $LiNO_3$ relative to the pristine with low activity. After electrochemical measurements, residual powder was characterized by FTIR and Raman spectroscopy. It was shown that high anodic polarization of the material tested in $LiNO_3$ causes the formation of triphylite $LiFePO_4$. Similarly, it is assumed that the electrochemical activity obtained by deep anodic polarization of the material in $NaNO_3$ electrolyte originates from the formed triphylite $NaFePO_4$. The obtained results open novel directions regarding the use of $NaFePO_4$ in metal-ion rechargeable batteries.