

**1st International Conference on Innovative Materials
in Extreme Conditions**



**PROGRAM
and
BOOK OF ABSTRACTS**

22-23 March 2022

Belgrade, Serbia

**1st International Conference on Innovative Materials
in Extreme Conditions**

**PROGRAM
and
BOOK OF ABSTRACTS**

22-23 March 2022

Belgrade, Serbia

Program and Book of Abstracts of The 1st International Conference on Innovative Materials in Extreme Conditions (IMEC2022) publishes abstracts from the field of material science, physics, chemistry, earth, and computation science on the phenomena arising during the processing and/or exploitation of the innovative materials, which are presented at the international conference on innovative materials in extreme conditions.

Editors-in-Chief

Dr. Rer. Nat. Branko Matović

Dr. Ivana Cvijović-Alagić

Dr. Vesna Maksimović

Publisher

Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade

Serbian Society for Innovative Materials in Extreme Conditions (SIM-EXTREME)

Printing layout

Dr. Ivana Cvijović-Alagić

Dr. Jelena Erčić

Press

Donat Graf d.o.o., Vučka Milićevića 29, 11306 Grocka, Belgrade, Serbia

ISBN 978-86-7306-158-0

CIP - Каталогизacija u publikaciji

Народна библиотека Србије, Београд

66.017/.018(048)

INTERNATIONAL CONFERENCE ON INNOVATIVE MATERIALS IN EXTREME
CONDITIONS

(1 ; 2022 ; BEOGRAD)

Program and book of abstracts / 1st International Conference on Innovative Materials in Extreme Conditions [i. e.] [(IMEC2022)], 22-23 March 2022 Belgrade, Serbia ; [organizers Serbian Society for Innovative Materials in Extreme Conditions [i. e.] (SIM-EXTREME) ... [et al.]] ; [editors-in-chief Branko Matović, Ivana Cvijović-Alagić, Vesna Maksimović]. - Belgrade : University, Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia : Serbian Society for Innovative Materials in Extreme Conditions (SIM-EXTREME), 2022 (Belgrade : Donat Graf). - 65 str. : ilustr. ; 30 cm

Str. 3: Preface / editors. - Bibliografija uz pojedine apstrakte.

ISBN 978-86-7306-158-0 (VINS)

а) Наука о материјалима -- Апстракти б)

Технички материјали -- Апстракти

COBISS.SR-ID 60606985

Preface

Dear conference participants and readers, we have the pleasure to welcome you all to Belgrade, Serbia as the venue for the 1st International Conference on Innovative Materials in Extreme Conditions (IMEC2022). This event is jointly organized by the Serbian Society for Innovative Materials in Extreme Conditions (SIM-EXTREME), the Center of Excellence "Center for Synthesis, Processing and Characterization of Materials for Application in Extreme Conditions - CEXTREME LAB", University of Belgrade, the Faculty of Science and Mathematics, University of Niš, and the Faculty of Mechanical Engineering, University of Belgrade.

The scope of the IMEC2022 is to become the worldwide forum for discussion of experts and young researchers on the phenomena arising during the processing and/or exploitation of the innovative materials. The IMEC2022 conference is focused on the current research in the field of material science, physics, chemistry, earth, and computation science. Experimental and computational investigations of materials obtained or operated under extreme conditions presented during the conference are highlighting recent progress in the development of the innovative materials at high pressures, under high magnetic and electric fields, over a wide range of temperatures, radiation conditions, corrosive environments, under extreme mechanical loads and non-equilibrium thermodynamic conditions. The interrelation between external effects, microstructural characteristics, and material properties is considered on the experimental and theoretical level to obtain new or enhanced insights into the material behavior and their application.

We want to use this opportunity to thank our sponsors and co-organizers for helping us to successfully organize the IMEC2022 conference. First of all, we want to mention that the Ministry of Education, Science and Technological Development of the Republic of Serbia recognized our conference as an important event and gave their financial endorsement. Also, we want to thank the Vinča Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade, for their strong financial support. In the end, we would like to thank all the members of the Conference Advisory Board, the Conference International Scientific Committee, and the Conference Organizing Committee who participated in the preparations of the IMEC2022 conference.

Editors

ORGANIZERS



Serbian Society for Innovative Materials in Extreme Conditions (SIM-EXTREME)



Center of Excellence "Center for Synthesis, Processing and Characterization of Materials for Application in Extreme Conditions" (CEXTREME LAB), Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade



Faculty of Science and Mathematics, University of Niš



Faculty of Mechanical Engineering, University of Belgrade

SPONSORS



*Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia,
University of Belgrade*



Ministry of Education, Science and Technological Development of the Republic of Serbia

Chair

Prof. Dr. Rer. Nat. Branko Matović *Center of Excellence “CEXTREME LAB”, Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia*

Advisory Board

Prof. Dr. Rer. Nat. N.V. Ravi Kumar *Indian Institute of Technology Madras, India*

Dr. Miladin Radović *Department of Materials Science and Engineering, Texas A&M University, USA*

Assoc. Prof. Dr. Claus Rebholz *Department of Mechanical and Manufacturing Engineering, University of Cyprus, Cyprus*

Prof. Gordana Bakić *Faculty of Mechanical Engineering, University of Belgrade*

Prof. Vladimir Ivanov *Russian Academy of Sciences (RAS), Kurnakov Institute of General and Inorganic Chemistry, Russian Federation*

Prof. Pavol Šajgalik *Institute of Inorganic Chemistry, Slovak Academy of Sciences, Slovak Republic*

Prof. Dr. Zoran Popović *Serbian Academy of Science and Art (SASA), Serbia*

Prof. Pei-Zhong Feng *School of Materials Science and Engineering, China University of Mining and Technology, PR China*

Prof. Lidija Ćurković *Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Croatia*

Dr. Vladimir Urbanovich *Centre of Science and Practice of Materials, National Academy of Sciences of Belarus, Belarus*

International Scientific Committee

Dr. Tetiana Prikhna *V. Bakul Institute for Superhard Materials, National Academy of Sciences of Ukraine, Ukraine*

Dr. Enikő Volceanov *Metallurgical Research Institute, Politehnica University of Bucharest, Romania*

Dr. Peter Tatarko *Institute of Inorganic Chemistry, Slovak Academy of Sciences, Slovak Republic*

Prof. Michele Cali *Electric, Electronics and Computer Engineering Department, University of Catania, Italia*

Prof. Dr. Branislav Jelenković *Serbian Academy of Science and Art (SASA), Serbia*

Dr. Ivana Cvijović-Alagić *Center of Excellence “CEXTREME LAB”, Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia*

Dr. Vesna Maksimović *Center of Excellence “CEXTREME LAB”, Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia*

PD Dr. Rer. Nat. Emanuel Ionescu *Fraunhofer-Einrichtung für Wertstoffkreisläufe und Ressourcenstrategie IWKS, Germany*

Dr. Jelena Zagorac *Center of Excellence “CEXTREME LAB”, Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia*

Prof. Aleksandra Zarubica *Faculty of Science and Mathematics, University of Niš*

Prof. Miloš Đukić *Faculty of Mechanical Engineering, University of Belgrade*

Organizing Committee

Dr. Rer. Nat. Dejan Zagorac	<i>Center of Excellence "CEXTREME LAB", Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia</i>
Dr. Jelena Stašić	<i>Center of Excellence "CEXTREME LAB", Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia</i>
Dr. Tamara Minović Arsić	<i>Center of Excellence "CEXTREME LAB", Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia</i>
Dr. Marija Prekajski Đorđević	<i>Center of Excellence "CEXTREME LAB", Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia</i>
Dr. Maria Čebela	<i>Center of Excellence "CEXTREME LAB", Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia</i>
Dr. Marjan Randelović	<i>Faculty of Science and Mathematics, University of Niš</i>
Dr. Filip Veljković	<i>Vinča Institute of Nuclear Sciences, University of Belgrade</i>
Vladimir Pavkov	<i>Center of Excellence "CEXTREME LAB", Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia</i>

Scientific Secretary

Dr. Jelena Erčić	<i>Center of Excellence "CEXTREME LAB", Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia</i>
------------------	---

TABLE OF CONTENTS

PROGRAM	13
22 nd March 2022	14
23 rd March 2022	16
PLENARY LECTURES	17
<i>Peter Tatarko, Hakan Ünsal, Alexandra Kovalčíková, Branko Matović, Zdeněk Chlup, Monika Tatarková, Michal Hičák, Ivo Dlouhý</i> Ultra-high temperature ceramics with improved ablation resistance	18
<i>Ravi Kumar</i> Design & development of precursor-derived ultra-high temperature resistant ceramic coatings and fibres for space applications	19
<i>Ivana Cvijović-Alagić, Slađana Laketić, Miloš Momčilović, Jovan Ciganović, Đorđe Veljović, Marko Rakin</i> Laser irradiation as an easy-to-apply method for Ti-based implant materials enhancement	20
<i>Dejan Zagorac</i> Innovative materials under extreme conditions: Multidisciplinary approach on multiscale level	21
INVITED LECTURES and ORAL PRESENTATIONS	22
<i>Zoltán Lenčేశ, Mohamed Radwan, Patrícia Petrisková, Adriana Czímerová, Peter Boháč, Pavol Šajgalík</i> Spinel-based ceramics for LEDs and photocatalytic applications	23
<i>Michal Hičák, Miroslav Hnatko, Zoltán Lenčేశ, Pavol Šajgalík</i> Surface modification of Si ₃ N ₄ -Y ₂ O ₃ composites – optimisation of oxyacetylene torch conditions	24
<i>Gordana Bakić, Milos Djukic, Bratislav Rajicic, Aleksandar Maslarevic, Vesna Maksimovic, Vladimir Pavkov, Nenad Milosevic</i> High Temperature Failures of Metals	25

<i>Miloš Đukić, Gordana M. Bakic, Vera Sijacki Zeravcic, Bratislav Rajicic, Aleksandar Sedmak, Muhammad Wasim, Jovana Perisic</i>	
Hydrogen embrittlement mechanisms in steels at different length scales	26
<i>Ondrej Hanzel, Zoltán Lenčes, Young-Wook Kim, Ján Fedor, Pavol Šajgalík</i>	
Silicon carbide - graphene composites with high functional properties	27
<i>Hakan Ünsal, Ondrej Hanzel, Salvatore Grasso, Alexandra Kovalčíková, Ivo Dlouhý, Peter Tatarko</i>	
Preparation and characterization of B ₄ C/TiB ₂ composites	28
<i>Branko Matović, Marija Prekajski Djordjevic, Marko Nikolic</i>	
Luminescence properties of Eu ³⁺ doped Mayenite under high pressure	29
<i>Jelena Maletaškić, Joshua Emory, Anna Gubarevich, Liao Nengqing, Katsumi Yoshida</i>	
Development of Highly Microstructure-Controlled Alumina Ceramics	30
<i>Vesna Maksimović, Nebojša Nikolić</i>	
Electrodeposition of powders in vigorous hydrogen evolution conditions	31
<i>Marjan Ranđelović, Aleksandra Zarubica, Branko Matović</i>	
Supercritical Hydrothermal Synthesis of ceramic powders in batch conditions	32
<i>Matej Fonović, Lovro Liverić, Neven Tomašić, Zoran Knežević</i>	
Layer formation on ternary Ni-10Cr-1Si (in wt.%) alloy upon low temperature gaseous nitriding	33
<i>Jelena Zagorac, Christian J. Schön, Dušica Jovanović, Dejan Zagorac, Tamara Škundrić, Milan Pejić, Branko Matović</i>	
Predicting stable modifications of Ce ₂ ON ₂ using a combination of global optimization and data mining	34
<i>Milovan Stoiljković, Suzana Veličković, Filip Veljković, Đorđe Kapuran</i>	
Generation of a laser-supported detonation (LSD) wave	35
<i>Zoran Jovanović, Andrzej Olejniczak, Nina Daneu, Matjaž Spreitzer, Danica Bajuk-Bogdanović, Željko Mravik, Vladimir Skuratov</i>	
The Effects of Swift Heavy Ion Irradiation on Structural Properties of Glassy Carbon	36
<i>Manuel Gruber, Walter Harrer, Raul Bermejo, Anton Tilz, Wolfgang Fimml, Andreas Wimmer</i>	
Ceramic Spark Plug Electrodes for Large Gas Engine Applications	37
<i>Branislav Jelenković</i>	
Ultra fast laser processing of materials for science and industry	38
<i>Claus Rebholz, Nikolaos Kostoglou, Branko Matovic</i>	
Thermal and chemical stability of boron nitride nanostructures	39

<i>Marija Prekajski Đorđević, Branko Matović, Jelena Maletaškić, Jelena Erčić, R. Subasri</i> Sintering properties of heavily Bi-doped CeO ₂	40
POSTER PRESENTATIONS	41
<i>Bratislav Todorović, Pavle I. Premović, Dragan T. Stojilković, Sreten B. Stojanović</i> ESR analysis of Mn ²⁺ cations at temperatures of 4.2-293 K in kerogen isolated from graptolitic black shale at Zvonačka Banja (Zvonce, Eastern Serbia)	42
<i>Dejan Zagorac, Ivana Cvijović-Alagić, Jelena Zagorac, Svetlana Butulija, Jelena Erčić, Ondrej Hanzel, Richard Sedlák, Maksym Lisnichuk, Tamara Škundrić, Milan Pejić, Dušica Jovanović, Peter Tatarko, Branko Matović</i> DFT study of structural stability and mechanical properties: High-Entropy Alloys (HEAs) - Ultra-High Temperature Ceramics (UHTC)	43
<i>Dušica Jovanović, Jelena Zagorac, Dejan Zagorac, Branko Matović</i> Structural, electronic and mechanical properties of bulk B ₄ C from first principles	44
<i>Dušica Jovanović, Dejan Zagorac, Branko Matović, Milan Pejić, Tamara Škundrić, Jelena Zagorac</i> Anion substitution and the structure-property influence of sulfur on mixed TiO ₂ /TiS ₂ compounds	45
<i>Filip Veljković, Branko Matovic, Svetlana Butulija, Milovan Stoilkovic, Ivana Stajcic, Bojan Jankovic, Suzana Velickovic</i> Laser desorption/ionization mass spectrometry of Li _{1.999} Ta _{0.005} SiO ₃	46
<i>Jelena Erčić, Dejan Zagorac, Olga Ivanova, Alexander Baranchikov, Taisiya Shekunova, Khursand Yorov, Olga Gajtko, Lili Yang, Marina Rumyantseva, Vladimir Ivanov, Branko Matović</i> Hydrogen peroxide-assisted route for nanocrystalline WO ₃ synthesis with excellent sensing response	47
<i>Jelena Zagorac, Dušica Jovanović, Dejan Zagorac, Tamara Škundrić, Milan Pejić, Branko Matović</i> Crystal structure and properties of theoretically predicted c-AlB ₁₂	48
<i>Ivana Ropuš, Lidija Ćurković, Sanda Rončević, Ivana Gabelica</i> Influence of temperature on corrosion of high purity alumina ceramics in acidic aqueous solution	49
<i>Tijana Stamenković, Nadežda Radmilović, Maria Čebela, Marija Prekajski-Đorđević, Vesna Lojpur</i> Investigation of Yb ³⁺ /Er ³⁺ doped SrGd ₂ O ₄ up-conversion nanomaterial obtained via combustion synthesis	50

<i>Tijana Stamenković, Nadežda Radmilović, Jelena Erčić, Maria Čebela, Vesna Lojpur</i> Synthesis and characterization of a new Dy ³⁺ and Sm ³⁺ doped SrGd ₂ O ₄ down-conversion nanomaterial obtained via glycine-assisted combustion synthesis	51
<i>Maria Čebela, Milena Rosić, Vesna Lojpur</i> Mechanochemical activation of starting oxide mixtures for solid-state synthesis of BiFeO ₃	52
<i>Milan Pejić, Dejan Zagorac, Jelena Zagorac, Tamara Škundrić, Dušica Jovanović, Branko Matović</i> Energy landscape and crystal structure investigations of holmium(III) fluoro-selenide HoFSe	53
<i>Milan Pejić, Dejan Zagorac, Jelena Zagorac, Tamara Škundrić, Dušica Jovanović, Branko Matović</i> Theoretical study of ground state properties of Na ⁺ , Cs ⁺ , Mg ²⁺ and Ba ²⁺ doped mayenite and its electride forms under extreme conditions	54
<i>Milan Vukšić, Irena Žmak, Lidija Čurković</i> Conventional and Unconventional Sintering of Alumina Ceramics	55
<i>Radojka Vujasin, Ksenija Kumrić, Aleksandar Devečerski, Mia Omerašević, Marija Egerić, Đorđe Petrović, Ljiljana Matović</i> Water under extreme conditions: simultaneous gamma irradiation/carbon char adsorption resulted in improved methylene blue degradation	56
<i>Sonja Jovanović, Marija Grujičić, Marko Jelić, Marija Vukomanović, Matjaž Spreitzer, Marjeta Maček-Kržmanc, Davide Peddis</i> Solvochemical synthesis of zinc- and gallium-substituted cobalt ferrite nanoparticles	57
<i>Svetlana Butulija, Jelena Maletaškić, Bratislav Todorović, Sanja Petrović, Aleksandra Dapčević, Branko Matović</i> Heavily Pb-doped Ce-solid solutions	58
<i>Tamara Škundrić, Dejan Zagorac, Johann Christian Schön, Jelena Zagorac, Milan Pejić, Dušica Jovanović, Branko Matović</i> Crystal structure prediction of novel Cr ₂ SiN ₄ compound under extreme conditions	59
<i>Tamara Škundrić, Dejan Zagorac, Aleksandra Zarubica, Jelena Zagorac, Milan Pejić, Dušica Jovanović, Peter Tatarko, Branko Matović</i> Mechanical and elastic properties of SiB ₆ : Theoretical investigations through ab initio calculations	60
<i>Vladimir Pavkov, Gordana Bakić, Vesna Maksimović, Miloš Đukić, Bratislav Rajičić, Aleksandar Maslarević, Branko Matović</i> Damage to a tube of output reheater due to gas corrosion	61

Nadežda Radmilović, Tijana Stamenković, Vesna Lojpur

Influence of host lattice on luminescence properties of up-conversion Ln_2MoO_6 (Ln=Y, Gd) powders co-doped with $\text{Er}^{3+}/\text{Yb}^{3+}$ synthesised at high temperatures 62

AUTHOR INDEX 63

Investigation of Yb³⁺/Er³⁺ doped SrGd₂O₄ up-conversion nanomaterial obtained via combustion synthesis

Tijana Stamenković, Nadežda Radmilović, Maria Čebela, Marija Prekajski Đorđević, Vesna Lojpur

*Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia, P.O. Box 522,
11001 Belgrade, University of Belgrade, Serbia*

Nanopowders of a new up-conversion materials, SrGd₂O₄ co-doped with different Yb³⁺ (1, 2.5 and 5 at%) and constant Er³⁺ (0.5 at%) concentrations were prepared by combustion method. X-ray powder diffraction (XRPD) showed that nanoparticles have orthorhombic structure (Pnma), assigned to the JCPDS Card No:01-072-6387. Rietveld refinement indicated a decrease in the size of the unit cell, lattice parameters, and cell volume, due to successful doping of Yb³⁺ and Er³⁺ ions into the host structure. Transmission electron microscopy (TEM) revealed that obtained nanostructure is composed of agglomerated nanoparticles, while energy dispersive spectroscopy (EDS) confirmed uniform distribution of all constituting elements in them. Up-conversion (UC) luminescence spectra measured in function of laser pumping power indicated that two-photon UC process is established in nanoparticles as a result of the trivalent erbium f-f electronic transitions: two green emission bands at 523 and 551 nm (²H_{11/2}, ⁴S_{3/2} → ⁴I_{15/2}) as well as a red emission band at 661 nm (⁴F_{9/2} → ⁴I_{15/2}). The rise of Yb³⁺ concentration from 1 to 5 at% provokes a significant change of the green to red ratio showing the ability to fine-tuning the color output.

ISBN 978-86-7306-158-0