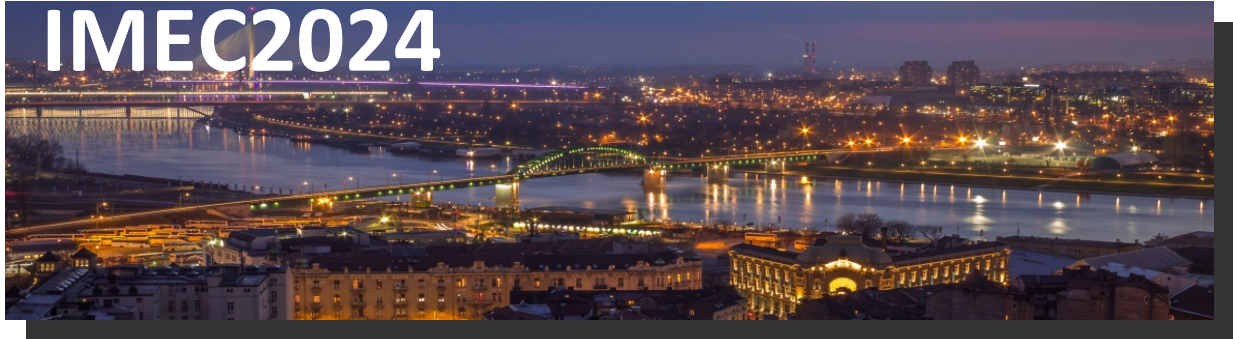


**2<sup>nd</sup> International Conference on Innovative Materials  
in Extreme Conditions**



**PROGRAM  
and  
BOOK OF ABSTRACTS**

**20-22 March 2024**

**Belgrade, Serbia**

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in Extreme Conditions**

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**Program and Book of Abstracts of the 2<sup>nd</sup> International Conference on Innovative Materials in Extreme Conditions (IMEC2024)** publishes abstracts from the field of material science, physics, chemistry, earth, and computational 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.

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***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

***Press***

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

**ISBN 978-86-7306-171-9**

CIP - Каталогизacija у публикацији  
Народна библиотека Србије, Београд

66.017/.018(048)

INTERNATIONAL CONFERENCE ON INNOVATIVE MATERIALS IN EXTREME  
CONDITIONS

(2 ; 2024 ; BEOGRAD)

Program ; and the Book of abstracts / 2nd International Conference on Innovative Materials in Extreme Conditions [i. e.] [(IMEC2024)], 20-22 March 2024 Belgrade, Serbia ; [organizers Serbian Society for Innovative Materials in Extreme Conditions (SIM-EXTREME) [and] University of Belgrade, Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, Center of Excellence "Center for Synthesis, Processing and Characterization of Materials for Application in Extreme Conditions" (CEXTREME LAB) [and] University of Belgrade, Faculty of Mechanical Engineering] ; [editors-in-chief Branko Matović ... [et al.]]. - Belgrade : University, Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia : Serbian Society for Innovative Materials in Extreme Conditions [i. e.] (SIM-EXTREME), 2024 (Belgrade : Donat Graf). - 82 str. : ilustr. ; 30 cm

Tiraž 70. - Str. 3: Preface / editors. - Bibliografija uz pojedine apstrakte. - Registar.

ISBN 978-86-7306-171-9 (VINS)

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

COBISS.SR-ID 139413001

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## **Preface**

*Dear conference participants and readers, we have the pleasure to welcome you all to Belgrade, Serbia, as the venue for the 2<sup>nd</sup> International Conference on Innovative Materials in Extreme Conditions (IMEC2024). 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" of the Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, and the Faculty of Mechanical Engineering, University of Belgrade.*

*The scope of the IMEC2024 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 IMEC2024 conference is focused on the current research in the field of material science, physics, chemistry, earth, and computational 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 IMEC2024 conference. First of all, we want to mention that the Ministry of Science, Technological Development and Innovation 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. We especially appreciate the support of the Royal Family of Serbia and the Serbian Royal Palace. 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 IMEC2024 conference.*

*Editors*

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# **PROGRAM**

## 20<sup>th</sup> March 2024

<b>9:00 – 16:00</b>	<b>Conference registration</b> (Exhibition hall)
<b>9:20</b>	<b>Conference opening and Welcome address</b> <i>Branko Matović, Conference Chair</i>
<b>SESSION A</b>	
<b>Session Chairs:</b> <i>Branko Matović, University of Belgrade, Serbia</i> <i>Ivana Cvijović-Alagić, University of Belgrade, Serbia</i>	
<b>9:30 – 10:00</b>	<i>Pavol Šajgalik, Slovak Academy of Sciences, Slovakia</i>
<b>Plenary Lecture</b>	Rapid hot-pressed silicon carbide ceramics for ultra-high temperature applications
<b>10:00 – 10:20</b>	<i>Tetiana Prikhna, National Academy of Sciences of Ukraine, Ukraine</i>
<b>Invited Lecture</b>	The high-temperature applicability of the Ti,Nb-Al-C MAX phases-based bulk materials and vacuum-arc deposited films
<b>10:20 – 10:35</b>	<i>Tatjana Volkov-Husović, University of Belgrade, Serbia</i>
<b>Oral Presentation</b>	Cavitation erosion resistance behavior of some refractory ceramics
<b>10:35– 10:50</b>	<i>Hakan Ünsal, Slovak Academy of Sciences, Slovakia</i>
<b>Oral Presentation</b>	Ablation performance of rare-earth modified ZrB <sub>2</sub> -SiC composites under oxyacetylene torch test
<b>10:50 – 11:20</b>	<b>Coffee break</b> (Exhibition hall)
<b>SESSION B</b>	
<b>Session Chairs:</b> <i>Pavol Šajgalik, Slovak Academy of Sciences, Slovakia</i> <i>Tatjana Volkov-Husović, University of Belgrade, Serbia</i>	
<b>11:20 – 11:50</b>	<i>Miloš Đukić, University of Belgrade, Serbia</i>
<b>Plenary Lecture</b>	Hydrogen embrittlement in additively manufactured metals: A concise review
<b>11:50 – 12:05</b>	<i>Manuel Gruber, University of Leoben, Austria</i>
<b>Oral Presentation</b>	Mechanical testing of brittle materials: from single crystals to ceramic systems



<b>12:05 – 12:20</b>	<i>Bratislav Rajičić, University of Belgrade, Serbia</i>
<b>Oral Presentation</b>	Erosion wear of HCCI alloys
<b>12:20 – 12:40</b>	<i>Alexandra Kovalčíková, Slovak Academy of Sciences, Slovakia</i>
<b>Invited Lecture</b>	A role of micro/nano graphene platelets on strengthening and toughening mechanisms of TiB <sub>2</sub> -SiC ceramic composites
<b>12:40 – 12:55</b>	<i>Lenka Ďaková, Slovak Academy of Sciences, Slovakia</i>
<b>Oral Presentation</b>	Effect of SiC whiskers on microstructure, mechanical and tribological properties of (TiZrHfNbTa)C
<b>12:55 – 14:30</b>	<b>Lunch break</b> (Conference venue)
<b>SESSION C</b>	
<b>Session Chairs:</b>	
<i>Claus Rebholz, University of Cyprus, Cyprus</i>	
<i>Nikolaos Kostoglou, University of Leoben, Austria</i>	
<b>14:30 – 14:50</b>	<i>Matej Fonović, University of Rijeka, Croatia</i>
<b>Invited Lecture</b>	Growth and stability of Ni <sub>3</sub> N layers obtained in pure ammonia at high temperatures
<b>14:50 – 15:05</b>	<i>Zoltán Lenčéš, Slovak Academy of Sciences, Slovakia</i>
<b>Oral Presentation</b>	Atomic layer deposition assisted graphite/ZnO composite anodes in Li-ion batteries
<b>15:05 – 15:20</b>	<i>Marko Jelić, University of Belgrade, Serbia</i>
<b>Oral Presentation</b>	Physicochemical properties of bismuth vanadate photoanode irradiated by swift heavy ions
<b>15:20 – 15:35</b>	<i>Željko Mravik, University of Belgrade, Serbia</i>
<b>Oral Presentation</b>	Utilization of swift heavy ions for modification of graphene oxide-based nanocomposites
<b>15:35 – 15:50</b>	<i>Ondrej Hanzel, Slovak Academy of Sciences, Slovakia</i>
<b>Oral Presentation</b>	Thermal and electrical conductivity of additive-free silicon carbide ceramics
<b>16:00 – 18:00</b>	<b>Poster Session</b> (Exhibition hall)
<b>18:00</b>	<b>Welcome reception</b> (Conference venue)

**21<sup>st</sup> March 2024**

<b>SESSION D</b>	
<b>Session Chairs:</b> <i>Alexandra Kovalčíková, Slovak Academy of Sciences, Slovakia</i> <i>Zoltán Lenčéš, Slovak Academy of Sciences, Slovakia</i>	
<b>09:30 – 09:50</b> <b>Invited Lecture</b>	<i>Subramshu Shekar Bhattacharya, Indian Institute of Technology - Madras, India</i>  Order amidst disorder in multicomponent high entropy oxides (HEOs): synthesis, characterization and applications
<b>09:50 – 10:10</b> <b>Invited Lecture</b>	<i>Peter Tatarko, Slovak Academy of Sciences, Slovakia</i>  Development and Integration of Entropy Stabilized Ceramics
<b>10:10– 10:25</b> <b>Oral Presentation</b>	<i>Dharma Teja Teppala, Technical University of Darmstadt, Germany</i>  Synthesis and high-temperature/high-pressure exposure of compositionally complex rock-salt-type transitional metal (carbo)nitrides
<b>10:25 – 11:00</b>	<b>Coffee break</b> (Exhibition hall)
<b>SESSION E</b>	
<b>Session Chairs:</b> <i>Tetiana Prikhna, National Academy of Sciences of Ukraine, Ukraine</i> <i>Dejan Zagorac, University of Belgrade, Serbia</i>	
<b>11:00 – 11:30</b> <b>Plenary Lecture</b>	<i>Miladin Radović, Texas A&amp;M University, USA</i>  MAX Phases: Overcoming the challenges of extreme environments
<b>11:30 – 12:30</b>	<b>Lunch break</b> (Conference venue)
<b>12:30 – 15:00</b>	<b>Guided visit to White Palace (the official residence of the former Yugoslav royal family)</b>
<b>20:00</b>	<b>Conference gala dinner</b>  Restaurant Caruso  <i>Address: Terazije 23/8, Belgrade</i>

22<sup>nd</sup> March 2024

<b>SESSION F</b>	
<b>Session Chairs:</b>	
<i>Miladin Radović, Texas A&amp;M University, USA</i>	
<i>Miloš Đukić, University of Belgrade, Serbia</i>	
<b>9:30 – 10:00</b>	<i>Ravi Kumar, Indian Institute of Technology - Madras, India</i>
<b>Plenary Lecture</b>	Small-scale mechanical testing of entropy stabilized ceramics
<b>10:00 – 10:20</b>	<i>Shanti Bhattacharya, Indian Institute of Technology - Madras, India</i>
<b>Invited Lecture</b>	Nano and micro optics on fibre tip: A possible solution for measurements in harsh environments
<b>10:20 – 10:35</b>	<i>Muniyappa Amarnath, Indian Institute of Information Technology Design and Manufacturing, India</i>
<b>Oral Presentation</b>	Experimental investigations to evaluate surface fatigue wear in journal bearing by using vibration signal analysis
<b>10:35 – 10:50</b>	<i>Ramachandra C G, Presidency University, India</i>
<b>Oral Presentation</b>	Experimental and simulation analysis of influence of stacking sequence on tensile and abrasion resistance of e-glass/jute fibre-based hybrid composites
<b>10:50 – 11:20</b>	<b>Coffee break</b> (Exhibition hall)
<b>SESSION G</b>	
<b>Session Chairs:</b>	
<i>Hari Kumar, Indian Institute of Technology - Madras, India</i>	
<i>Peter Tatarko, Slovak Academy of Sciences, Slovakia</i>	
<b>11:20 – 11:40</b>	<i>Maria Čebela, University of Belgrade, Serbia</i>
<b>Invited Lecture</b>	Enhancement of weak ferromagnetism, exotic structure prediction and diverse electronic properties in bismuth ferrite and holmium-substituted multiferroic bismuth ferrite
<b>11:40 – 11:55</b>	<i>Dejan Zagorac, University of Belgrade, Serbia</i>
<b>Oral Presentation</b>	Study of lanthanum fluoride selenides using a combination of crystal structure prediction and DFT calculations with experimental synthesis and characterization
<b>11:55 – 12:10</b>	<i>Dušica Jovanović, University of Niš, Serbia</i>
<b>Oral Presentation</b>	DFT study of new hybrid organic-inorganic perovskites: guanidinium-BX <sub>3</sub> substituted by B = (Sr <sup>2+</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup> , Be <sup>2+</sup> ) and X = (Cl <sup>-</sup> , F <sup>-</sup> )

<b>12:10 – 12:30</b>	<i>Thomas Bräuniger, Ludwig-Maximilians-University of Munich, Germany</i>
<b>Invited Lecture</b>	NMR spectroscopy as a structure elucidation tool for compounds synthesised under high temperature and high pressure conditions
<b>12:30 – 14:00</b>	<b>Lunch break</b> (Conference venue)
<b>14:00</b>	<b>Conference closing ceremony</b>

## Purity and surface area: Key factors on thermal stability and oxidation resistance of BN nanoplatelets

**Nikolaos Kostoglou<sup>1</sup>, Sebastian Stock<sup>2</sup>, Angelos Solomi<sup>1,3</sup>, Damian Holzapfel<sup>4</sup>, Steven Hinder<sup>5</sup>, Mark Baker<sup>5</sup>, Georgios Constantinides<sup>6</sup>, Vladislav Ryzhkov<sup>7</sup>, Jelena Maletaskic<sup>8</sup>, Branko Matovic<sup>8</sup>, Jochen Schneider<sup>4</sup>, Claus Rebholz<sup>1,3</sup>, Christian Mitterer<sup>1</sup>**

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This study delves into the influence of purity and surface area on the thermal and oxidation properties of hexagonal boron nitride (h-BN) nanoplatelets, crucial factors in high-temperature oxidizing environments. Three h-BN nanoplatelet-based materials, synthesized with different purity levels and surface areas, were compared, including also a high-purity commercial BN reference. All materials were systematically analyzed by various characterization techniques, such as scanning electron microscopy, X-ray diffraction, Fourier-transform infrared radiation, X-ray photoelectron spectroscopy, gas sorption analysis and thermal gravimetric analysis coupled with differential scanning calorimetry. Results indicated a clear enhancement in thermal stability and oxidation resistance of the synthesized materials with increased purity. Furthermore, the reference material with its high purity and low surface area showed a superior performance, which was attributed to the minimized reactive sites for oxygen diffusion due to fewer defects, highlighting the critical roles of both sample purity and accessible surface area in h-BN's thermo-oxidative stability. These findings offer valuable insights for the development of BN-based nanomaterials, suggesting a strategic focus on purity and surface area control, while providing a pathway for optimizing their performance in applications facing extreme thermal and oxidative conditions.

**ISBN 978-86-7306-171-9**