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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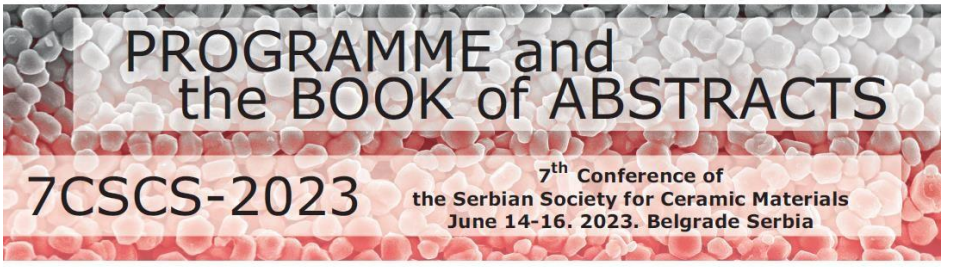

Edited by:
Branko Matović
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Programme and Book of Abstracts of The Seventh Conference of The Serbian Society for Ceramic Materials **publishes abstracts from the field of ceramics, which are presented at international Conference.**

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Publisher
Institut za multidisciplinarna istraživanja
Kneza Višeslava 1, 11000 Belgrade, Serbia

For Publisher
Dr Dragica Stanković

Printing layout
Dr. Jelena Maletaškić, Vladimir V. Srdić

Press
Faculty of Technology and Metalurgy, Research and Development Centre of Printing Technology, Karnegieva 4, Belgrade, Serbia

Published: 2023

Circulation: 120 copies

CIP – Каталогизација у публикацији
Народна библиотека Србије, Београд

666.3/.7(048)
66.017/.018(048)

DRUŠTVO za keramičke materijale Srbije, Konferencija (7; 2023, Beograd)
Programme ; and the Book of Abstracts / 7th Conference of The Serbian Society for Ceramic Materials, 7CSCS-2023, June 14-16, 2023 Belgrade, Serbia ; [organizers] The Serbian Society for Ceramic Materials ... [et al.] ; edited by Branko Matović, Aleksandra Dapčević, Vladimir V. Srdić. - Belgrade :
Institut za multidisciplinarna istraživanja, 2023 (Belgrade : Faculty of technology and metalurgy, Research and development centre of printing technology). -124 str. : ilustr. ; 25 cm
Tiraž 120. – Str. 7: Welcome message / Branko Matović. - Registar.

ISBN 978-86-80109-24-4

a) Керамика -- Апстракти b) Наука о материјалима – Апстракти v) Наноматеријали -- Апстракти

COBISS.SR-ID 117544969

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June 14-16, 2023
Belgrade, Serbia
7CSCS-2023

Edited by:
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SPECIAL THANKS TO

Република Србија
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ТЕХНОЛОШКОГ РАЗВОЈА И ИНОВАЦИЈА

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with ultrafine Ir nanoparticles [2]. We demonstrate that transforming the top surface morphology of supporting TNT arrays from ordered open-top tubes to bundled nanowires ("nanograss") is beneficial for exposing more Ir active centers during the HER operation. Consequently, applying very low concentrations of Ir(III) ions in the galvanic displacement step is sufficient to produce exceptionally active nanograss-modified Ir@TNT composites. An optimum Ir@TNT, possessing a low Ir loading of 5.7 μg_{Ir} cm^{-2}, requires overpotential of only –63 mV to reach a current density of –100 mA cm^{-2} and shows a stable long-term performance in a 1 M $HClO_4$ solution. Computational simulations suggest that the hydrogen-rich TiO_2 support not only strongly interacts with anchored Ir particles and weakens their H binding strength to a moderate level, but also actively provides hydrogen for rejuvenation of the Ir active sites at the Ir|H-TiO_2 interface, thereby significantly enhancing HER catalysis.

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O-15

SYNTHESIS OF BISMUTH VANADATE PHOTOCATALYST WITH ENHANCED ADSORPTION PROPERTIES

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Efficiency of a semiconductor catalyst is directly correlated to its surface to which a reactant species is adsorbed. There are several ways to optimize the active surface, such as synthesis, processing or any aftertreatment of a photocatalytic material. Our research was focused on modifying the existing sonochemically assisted synthesis of bismuth vanadate.

Two optimization methods were used in order to increase specific surface of the photocatalyst and number of its active sites. The first method was to change concentration of reactants used in the synthesis to reduce agglomeration of bismuth vanadate. Sonochemically assisted synthesis was performed with three different concentrations of reactants to observe agglomeration tendency of the catalyst. The other method included the use of sodium dodecyl sulfate (SDS) as a surfactant in synthesis at highest concentration in order to hinder the particle growth.

Bismuth vanadate was shown to degrade mordant blue 9 dye (MB9) most effectively in alkaline medium (pH = 13) under visible light, discoloring the solution in under 2 hours, while the highest adsorption of MB9 is observed in acidic solution (pH = 1).

O-16

THE DEVELOPMENT OF COST-EFFECTIVE CARBON-BASED TRANSPARENT ELECTRODES IN THE MID-INFRARED REGION

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The discovery of indium tin oxide (ITO) in the 19th century had a great impact on the development of transparent conductive electrodes. Transparent conductive electrodes are required to comply with the requirements of high transparency in a certain range and good conductive properties in order to be used as part of optoelectronic devices, such as touch screen panels, OLED, LCD, IR sensors and so on. The transparency above 90 % in the visible range and low sheet resistance made ITO the most widely used material as a transparent electrode. However, the high production cost, brittle nature and relatively low transparency in the IR spectrum of ITO material are serious limitations that needed to be overcome [1,2]. On the other hand, since the discovery in 1991, carbon nanotubes (CNTs) have been recognized as potential alternatives for ITO films due to their exceptional optical and electrical properties, including in the IR region. To take full advantage of the extraordinary properties of these unique nanostructured materials, they must be uniformly integrated and crosslinked into light-weight matrices, such as those provided by various synthetic polymers [3].

We have developed a thin film material composed of CNT-polymer that exhibits remarkable transparency in both visible and IR ranges. Produced films have achieved a transparency of about 80 % and 70 % in the UV-VIS and mid-IR range (2.5–3.5 μm wavelength), which is significantly higher than the 20 % transparency typically observed in commercial ITO films, in the mid-IR range. The samples showed a decreasing trend of transparency with increasing number of bilayers. The sheet resistance of fabricated thin films was about 15 kΩ/sq with a tendency to decrease with the number of bilayers.

Furthermore, produced CNT-based film offers the added benefit of electrical conductivity suitable for serving as a transparent electrode, and it is manufactured through a cost-effective process. The Layer by Layer (LbL) deposition method is a