



**Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION VIII
New Frontiers in Multifunctional Material Science and Processing**

**Serbian Ceramic Society
Institute of Technical Sciences of SASA
Institute for Testing of Materials
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials**

PROGRAM AND THE BOOK OF ABSTRACTS

**Serbian Academy of Sciences and Arts, Knez Mihailova 35
Serbia, Belgrade, 23-25. September 2019.**

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Book title: Serbian Ceramic Society Conference - ADVANCED CERAMICS AND APPLICATION
VIII Program and the Book of Abstracts

Publisher:

Serbian Ceramic Society

Editors:

Prof.dr Vojislav Mitić

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Technical Editors:

Dr Ivana Dinić

Dr Marina Vuković

Printing:

Serbian Ceramic Society, Belgrade, 2019

Edition:

100 copies

CIP - Каталогизacija y публикацији
Народна библиотека Србије, Београд

666.3/.7(048)

66.017/.018(048)

SRPSKO keramičko društvo. Conference Advanced Ceramics and Application : New Frontiers in
Multifunctional Material Science and Processing (8 ; 2019 ; Beograd)

Program ; and the Book of abstracts / Serbian Ceramic Society Conference Advanced Ceramics
and Application VIII : New Frontiers in Multifunctional Material Science and Processing, Serbia,
Belgrade, 23-25. September 2019. ; [organized by] Serbian Ceramic Society ... [etc.] ; [editors
Vojislav Mitić, Lidija Mančić, Nina Obradović]. - Belgrade : Serbian Ceramic Society, 2019
(Belgrade : Serbian Ceramic Society). - 98 str. : ilustr. ; 30 cm

Tiraž 100.

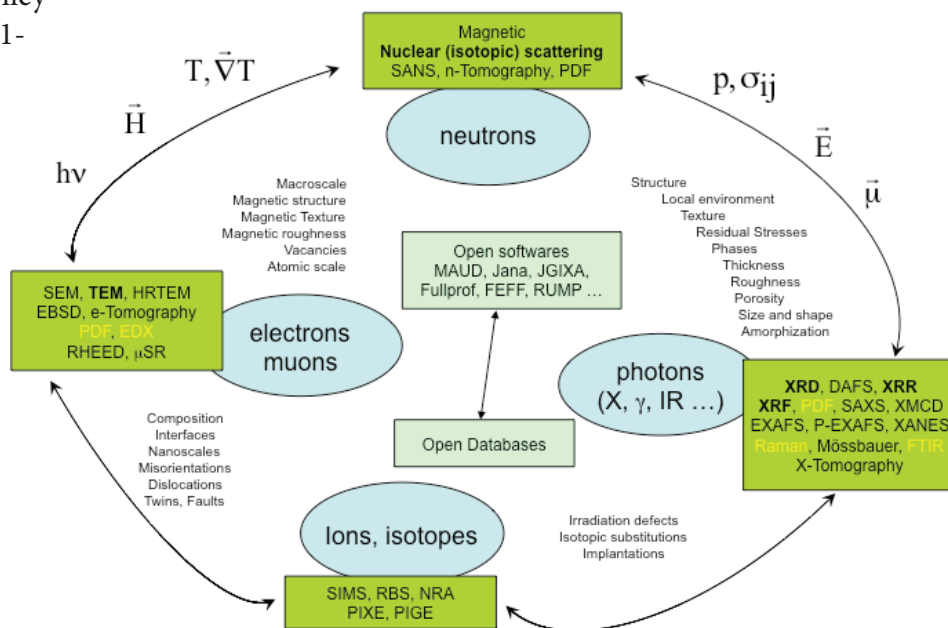
ISBN 978-86-915627-7-9

а) Керамика -- Апстракти б) Наука о материјалима -- Апстракти в) Наноматеријали --
Апстракти

COBISS.SR-ID 279041804

The Combined Analysis vision

for future. D. Chateigner (Ed.)
(2010): Combined analysis, Wiley-
ISTE, 496p. ISBN: 978-1-84821-
198-8



KN 5

Synthesis of Ce/Ru Doped ZnO photocatalysts to the degradation of emerging pollutants in wastewater

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Semiconductor nanoparticles (NPs) and nanowires (NWs) of doped ZnO system with different dopant content have been synthesised by Polyol-Mediated Thermolysis (PMT) process and Vapour-Solid (VS) reaction. The average crystallite size, morphology, specific surface area, and direct band gap have been evaluated. The structural and functional characteristics have been studied by X-Ray Diffraction techniques (XRD), Field Emission Scanning Electron Microscope (FESEM), High Resolution Transmission Electron Microscopy (HRTEM), Brunauer, Emmett and Teller (BET) method, UV-Vis Diffuse Reflectance Spectra (DRS), UV-Vis Spectroscopy, and Photoluminescence measurements (PL). Also, the photocatalytic activities of pure and doped ZnONPs were evaluated by removal rate of Methylene Blue (MB) under UV irradiation (365 nm) at room temperature. XRD patterns revealed the common hexagonal ZnO Wurtzite-type structures with a preferred orientation of (101) plane. Secondary phases as CeO₂, Ce₂O₃, Ce, RuO₂, Ru₃O₄, Ru have been

identified. For both dopant, Ce and Ru, and for all the concentrations in the precursor solution, FESEM and HRTEM showed NPs with morphologies ranging from spherical/ellipsoidal to hexagonal. The size of NPs was observed to decrease (from ~30 to ~16 nm) with increasing doping concentration due to the interaction between the Ce-O-Zn or Ru-O-Zn ions. EDS results confirmed the incorporation of Ce or Ru ions into ZnO lattice. Using the Kubelka-Munk treatment on the diffuse reflectance spectra, the direct band gap energy has been estimated to be slightly lower than 3.0 eV in both, the Ce and Ru-doped samples. Compared with pure ZnO NPs, the PL spectra of the doped NPs showed red-shifted UV emission and an enhanced blue emission with the typical broad green-yellow emission. The results showed that photocatalytic efficiency of doped ZnO NPs was always enhanced.

KN 6

Hydrothermal synthesis of the oxide powders

Srečko Stopic, Bernd Friedrich

IME Process Metallurgy and Metal Recycling of the RWTH Aachen University, Germany

The high demand for new materials, such as oxides, and composites, raises the need for an advanced synthesis of different materials, which are crucial for technological applications. Different process synthesis routes, such as atomization, reduction in aqueous phase, crystallization, chemical precipitation, high pressure reaction in autoclave, and electrolysis, can be used to create controlled powder characteristics with specific properties for a particular application or industry. Advances in synthesis explore a range of materials and techniques used for powder metallurgy and the use of this technology across a variety of application areas such as medicine, catalysis and automotive industry. The main aim of this work is the synthesis of nanosilica and magnesium carbonate in an autoclave. Hydrothermal synthesis with a process design of a carbonation process will be presented. Depending on the reaction parameters such as a temperature, pressure and stirring speed, it is possible to control the morphological characteristics of the obtained particles.

KN 7

New sustainable processing of RE-based magnetic materials

Spomenka KOBE

Jožef Stefan Institute, Ljubljana, Slovenia

Rare-Earth Transition Metal permanent magnets (RETM-PM) are vital components in the rapidly-developing renewable energy sector, where the motors require strong magnets with the ability to operate at temperatures well over 100°C. To achieve high coercivity, remanence and consequently high energy product (the figure of merit for PM) at elevated temperatures, the addition of heavy rare earths (HREs) to the basic Nd-Fe-B composition is needed. However, HREs are on the very top of the list of Critical Raw Materials (CRM) published by the EC in 2017.

In the frame of the “Magnetic Materials Group” of IJS, Ljubljana, we have developed an innovative, and sustainable way to drastically decrease the amount of HREs needed for the highest-level performance of PM. In the second part of the talk, we will focus on the need for recycling of the end-of-use (EoU) RETM-PM.

To drastically reduce the use of HREs, we focused on developing a new method, which was designed to enable us to achieve the properties needed for high-temperature applications with the lowest amount of scarce elements. With our new inventive technique, further transferred to pilot production, we could minimize down to 0.2 at % the amount of HREs used whereas the improvement of coercivity was 30 % with minimal loss in remanence. The total saving of the HREs turned to be 16-times less for the same performance, which is a significant contribution to the world economy and clean, sustainable environment. In studying the mechanism for such an improvement in coercivity without significantly decreasing the remanence, a detailed microstructure investigation was performed by using high-resolution transmission electron microscopy.