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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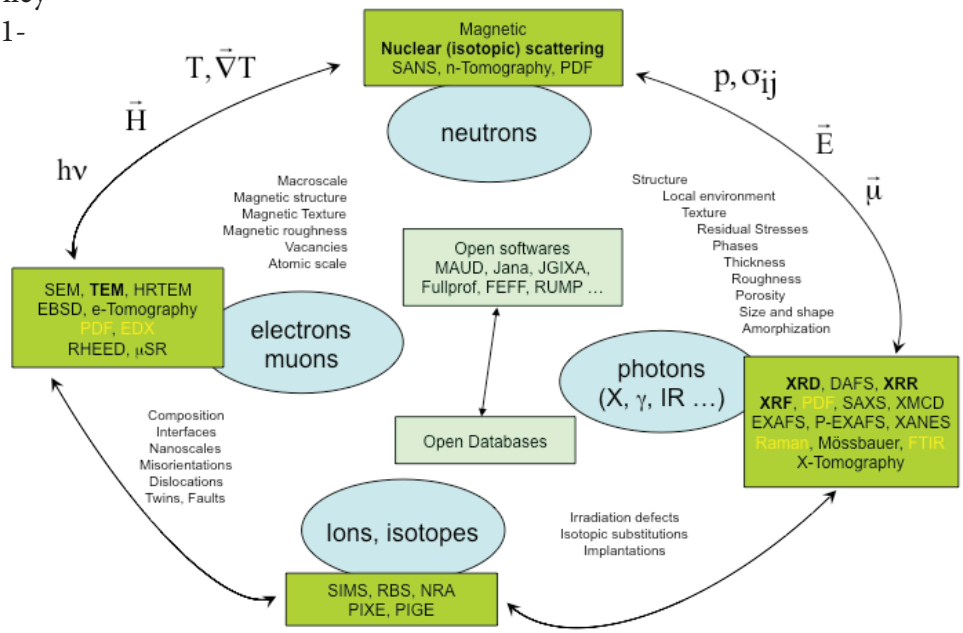

KN 5

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 systemwith different dopant content have been synthesisedby Polyol-Mediated Thermolysis (PMT) process and Vapour-Solid (VS) reaction. The average crystallite size, morphology, specific surface area,anddirect band gap havebeen evaluated. The structural and functional characteristics have been studiedby 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 commonhexagonal ZnOWurtzite-type structures with apreferred orientation of (101) plane.Secondary phases as CeO_2, Ce_2O_3, Ce, RuO_2, Ru_3O_4, Ruhave been

identified. For both dopant, Ceand Ru, and for all the concentrations in the precursor solution, FESEM and HRTEM showed NPswith 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 andRu-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 oxidepowders

Srecko 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 explores 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

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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 developedaninnovative, 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.