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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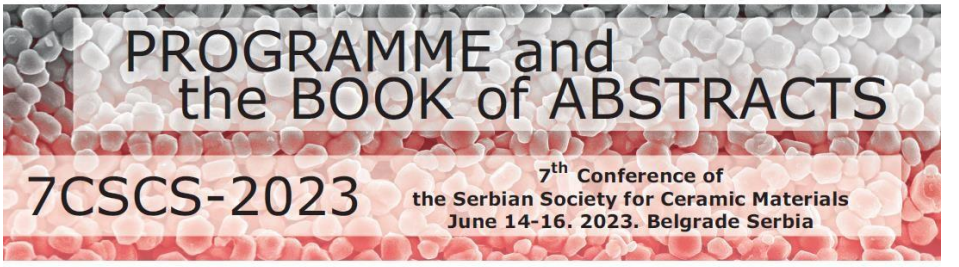

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Branko Matović
Jelena Maletaškić
Vladimir V. Srdić

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June 14-16, 2023
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7CSCS-2023

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SPECIAL THANKS TO

Република Србија
МИНИСТАРСТВО НАУКЕ,
ТЕХНОЛОШКОГ РАЗВОЈА И ИНОВАЦИЈА

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Ag/ZnO NANOCOMPOSITES FOR PHOTOCATALYTIC APPLICATION

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In this work, the decoration of noble metal nanoparticles on a semiconductor surface was used as a strategy to reach strong visible light absorption and efficient electron-hole separation to enhance the photocatalytic activity of ZnO.

The Ag-modified ZnO nanopowders were obtained by the green synthesis. Zinc acetate dihydrate with different silver nitrate content (0, 0.75, 1.5 and 3 mol%) was dissolved in ethylene glycol in the presence of chitosan. The obtained mixtures in the form of gel were heated at 150 °C for 2 h and subsequently calcined at 400 °C for 1 h. The obtained samples were characterized by XRPD, FESEM, HRTEM, and UV-vis techniques while the photocatalytic efficiency was tested by monitoring the degradation of textile dyes Reactive Orange 16 (RO16), Acid Green 25 (AG25), Mordant Blue 9 (MB9), and Ethyl Violet (EV) then compared with the commercial ZnO nanopowder.

The results showed that the Ag/ZnO samples consisted of ZnO nanoparticles with an average crystallite size of about 25 nm and Ag (20–30 nm) distributed on the surface of ZnO. The uniformity in size and nearly spherical shape of ZnO nanoparticles, forming various forms of agglomerates, were observed. Compared to both, the unmodified and commercial ZnO, all the prepared Ag/ZnO composites showed a broad band in the visible region at 500 nm, resulting in a narrowing of the band gap. This band confirms the surface plasmon resonance of the metallic Ag nanoparticles, since they can absorb visible light and activate the photocatalyst in the visible spectrum.

All the obtained nanopowders showed higher adsorption power and photocatalytic activity in the degradation of RO16 dye than the commercial ZnO. The powder with 1.5 mol% of Ag had the highest photocatalytic efficiency as a consequence of smaller Ag particles and their good distribution, as well as the narrowest band gap. This means that the photocatalytic activity does not depend on the Ag content only and that the size and distribution of the metal particles play an important role. Since the ZnO with 1.5 mol% of Ag demonstrated the best photocatalytic activity, the same sample was tested for diverse dyes and the high photocatalytic efficiency was also confirmed by testing on AG25, MB9 and EV dyes.