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

Faculty of Mechanical Engineering, University of Belgrade

Center of Excellence for Green Technologies, Institute for Multidisciplinary Research, University of Belgrade

Faculty of Technology and Metallurgy, University of Belgrade

PROGRAMME and the BOOK of ABSTRACTS

6CSCS-2022

6th Conference of the Serbian Society for Ceramic Materials
June 28-29. 2022. Belgrade Serbia

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Branko Matović
Aleksandra Dapčević
Vladimir V. Srdić

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HIERARCHICAL ZnO/SnO_2 HETEROSTRUCTURES VIA HYDROTHERMALLY ASSISTED ELECTROSPINNING TECHNIQUE: SYNTHESIS AND PHOTOCATALYTIC PERFORMANCES

Katarina Vojisavljević[1], Jelena Vukašinović[1,2], Milica Počuča-Nešić[1,2], Slavica Savić[3], Matejka Podlogar[4], Olivera Zemljak[1,2], Zorica Branković[1,2]

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Hierarchical nanostructures with multiporous tin oxide nanofibers (SnO_2-MPNFs) and zinc oxide nanorods (ZnO-NRs) have been synthesized by combining electrospinning technique and hydrothermal method. A solution containing uniformly distributed tin (Sn) and silicon (Si) species of precursors, as well as a sacrificial polymer (PVP) was electrospun using a single-nozzle spinneret to fabricate nanofibers. In virtue of the Kirkendall effect driven by calcination at 550 °C, the SiO_2-cored SnO_2 nanofibers (SnO_2-SiO_2-NFs) deliberated from PVP were formed and used as backbones for further hydrothermal growth of ZnO-NRs. By varying the hydrothermal reaction time (0.5–2 h) at the constant concentration of SnO_2-SiO_2-NFs, zinc (Zn) precursor, directing agent (hexamethylenetetramine, HMT) and aqueous ammonia, the density, length and thickness of ZnO-NRs were controlled. Nanofibers and ZnO-NRs/SnO_2-MPNFs heterostructures are confirmed by X-ray diffraction (XRD), field-emission scanning electron microcopy (FE-SEM), energy dispersive spectrometer (EDS), transmission electron microscopy (TEM) and elemental mapping analysis.

The hydrothermal treatment conducted at 90 °C in aqueous ammonia allowed: a) selective etching of SiO_2 from the SnO_2-SiO_2-NFs core and SiO_2 trapped between SnO_2 particles, and b) effective growth of ZnO-NRs. The process resulted in ZnO-NRs/SnO_2-MPNFs heterostructures with ZnO-NRs of 1–5 μm in length attached to SnO_2-MPNFs, the shell of which was composed of ultra-fine SnO_2 crystallites (~5 nm in size) and where the four porous channels create the core instead of SiO_2. Photocatalytic performance of the heterostructures was investigated toward different organic azo-dyes (methylene blue, methyl orange) and obvious enhancement was demonstrated in degradation of the organic pollutant, compared to primary SnO_2-based nanofibers.