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

7CSCS-2023

7th Conference of the Serbian Society for Ceramic Materials
June 14-16. 2023. Belgrade Serbia

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Branko Matović
Jelena Maletaškić
Vladimir V. Srdić

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SPECIAL THANKS TO

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ТЕХНОЛОШКОГ РАЗВОЈА И ИНОВАЦИЈА

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THE INFLUENCE OF SPARK PLASMA SINTERING TEMPERATURE ON THE PROPERTIES OF Sb-DOPED BARIUM STANNATE CERAMICS

Jelena Mitrović[1,2], Milica Počuča-Nešić[1,2], Aleksandar Malešević[1,2], Olivera Zemljak[1,2], Matejka Podlogar[3], Sandra Drev[3], Slavko Bernik[3], Goran Branković[1,2]

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Barium-stannate ($BaSnO_3$, BSO) is a member of the perovskite-type alkaline earth stannates $ASnO_3$ (A = Ca, Sr, Ba) with an ideal cubic crystal structure (space group: $Pm\bar{3}m$). Doping with antimony (Sb^{5+}) can change this wide band-gap semiconductor (E_g = 3.1-3.4 eV) into an *n*-type semiconductor with high electrical conductivity at room temperature. The major drawbacks in the BSO-based ceramics synthesis are phase composition and low density of final ceramic materials. These problems could be solved using spark plasma sintering (SPS), a current and pressure-assisted technique, which enables the preparation of dense ceramics at significantly lower temperatures and for a shorter time.

To investigate the influence of spark plasma sintering temperature on the structural, microstructural and electrical properties of $BaSn_{1-x}Sb_xO_3$ (BSSO, x = 0.00; 0,04; 0.06; 0.08; and 0.10) ceramics samples, BSSO powders were spark plasma sintered at 1100 °C, 1200 °C and 1250 °C for 5 min.

X-ray diffraction (XRD) analysis confirmed that all ceramic samples sintered at 1100 °C crystallized in a single-phased cubic BSO structure. Their relative densities were in the range of 72–82% ρ_t. Sintering at 1200 °C increased the samples' relative densities to 79–96% ρ_t, but also induced the formation of a barium-rich secondary phase, Ba_2SnO_4. Rising the sintering temperature further to 1250 °C induced the melting of all samples except $BaSn_{0.92}Sb_{0.08}O_3$. Field emission scanning electron microscopy (FE-SEM) revealed that doping with antimony decreased the grain sizes in BSSO samples sintered at 1100 °C and 1200 °C up to the concentration x = 0.08.

Electrical measurements revealed the typical semiconductor behavior of the undoped samples, showing nonlinear current-voltage characteristic and the existence of one semicircle in their impedance spectra, characteristic for materials with double Schottky barrier at the grain boundaries. However, samples with higher dopant concentrations (x = 0.08 and 0.10) showed significantly lower electrical resistivity and linear current-voltage characteristic. The lowest and almost constant value of electrical resistivity in the temperature range of 25–150 °C, and complete loss of the semicircle in its impedance spectrum revealed the metallic-like behavior of sample $BaSn_{0.92}Sb_{0.08}O_3$ sintered at 1200 °C.