



Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION XI
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, 18-20. September 2023.

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P4

Effect of grain size and domain structure on electrical properties of rare earth doped BaTiO₃ ceramics

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The influence of microstructure, grain size, and domain structure on the electrical properties of Ho, Er, and Yb-doped BaTiO₃ ceramics was investigated in this paper. The samples were doped with rare earth ions from 0.01 to 1.0 at% and sintered at 1320°C and 1350°C. The samples were obtained by conventional solid-state sintering technique.

All samples sintered at a low temperature (1320°C) are characterized by a fine-grained microstructure with an average grain size of 2-6 μm. In the samples doped with a higher concentration of dopants (greater than 0.5at%) and sintered at a higher temperature (1350°C), the appearance of secondary abnormal grains with a domain structure was noticed. All investigated samples are insulators and show high electrical resistivity. For ceramics doped with a lower concentration of additives (0.01 and 0.1 at% Ho, Er, and Yb) sintered at 1350°C, the higher values of the dielectric constant were obtained. Lower values of dielectric constant were measured for samples with an additive content above 0.5 at%, and they are a consequence of secondary abnormal grain growth and the presence of non-ferroelectric phases. All investigated samples have low dielectric loss values, ranging from 0.01 to 0.06. Dielectric parameters, characteristic for this type of doped ceramics, such as Curie temperature, Curie constant, and Curie - Weiss temperature, were calculated for all samples.

P5

Fabrication of porous anorthite-based ceramics using solid wastes for cost-effective thermal insulation of buildings

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There is a global tendency to reduce the consumption of energy required for heating as well as cooling buildings. Therefore, thermal insulation technology becoming important in preventing both, the gain and loss of heat through the building envelope. This work aims to evaluate the feasibility of using inexpensive raw materials such as kaolin and waste material such as seashells and banana peel for fabrication of the sustainable anorthite-based porous ceramics for thermal insulation. Kaolin was used as a source of Al₂O₃ and SiO₂, seashells as a source of CaO whereas banana peel was used as a pore former. The phase composition, bulk density, open porosity, compressive strength, microstructure, and thermal conductivity of the ceramic samples, were analyzed. The obtained results showed that the variation of pore

former (banana peel) content and sintering temperature was an effective way to control the thermo-mechanical properties of the obtained anorthite ceramics. Samples with open porosity (1.4 – 45%), compressive strength (>15 MPa), bulk density (1.87-2.62 g/cm³), and thermal conductivity (0.097-3.67W/mK) were obtained after sintering of samples with different percent of banana peel at 1100–1200 °C. It suggests that the obtained porous ceramics can be used for cost-effective thermal insulation of buildings.

P6

Tailoring the ZnO/RuO₂ ratio in composite electrocatalysts for efficient HER and OER

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The increasing demand for efficient catalysts has raised concerns about the limited availability and high cost of platinum group metal (PGM) catalysts. Ruthenium dioxide (RuO₂) has shown remarkable catalytic activity; however, its extensive use is hindered by its high cost. To tackle this challenge, we investigated the utilization of zinc oxide (ZnO) as a promising alternative to reduce reliance on expensive RuO₂ catalysts while maintaining catalytic performance by synthesizing ZnO/RuO₂ composites in various mass ratios (1:1, 2:1, 10:1) through microwave processing of a precipitate, followed by calcination at temperatures of 300 and 600 °C. The crystallinity and phase purity of the particles were analyzed using X-ray powder diffraction (XRD) and Raman spectroscopy. Surface chemistry was examined by Fourier-transform infrared (FTIR) spectroscopy. Field emission scanning electron microscopy was employed to investigate the morphology and particle size. Photoluminescence and UV-Vis diffuse reflectance spectroscopy were utilized for analyzing the optical properties. The electrocatalytic activity of the materials were evaluated via linear sweep voltammetry in both acidic (0.1 M H₂SO₄) and alkaline (0.1 M NaOH) electrolytes. The ZnO/RuO₂ composites exhibited outstanding catalytic performance for both the hydrogen evolution reaction (HER) and the oxygen evolution reaction (OER) in both types of electrolytes.