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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Electrical Characteristics of Ho doped $BaTiO_3$ Ceramics Using New Measurement Method

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In this paper, electrical characteristics of Ho_2O_3 doped $BaTiO_3$ ceramics were shown, using new method for measuring samples. The $BaTiO_3$ doped samples were sintered at 1320°C for 4 hours. The concentration of the additives were from 0.05 to 1.0 at% Ho. The density was ranged from 83% to 91% of theoretical density (TD). The samples of $BaTiO_3$ ceramics doped with Ho_2O_3 are characterized by spherical and irregular polygonal grains. The average grain size for samples doped with low content of Ho_2O_3 (0.05 at% Ho) ranged from 10 μm to 30 μm. An increase in dopant concentration causes a decrease in the average grain size in the investigated samples. So it is for samples doped with 1.0 at% Ho, grain size range between less than 1 μm – 2 μm. The variation of dielectric permittivity with temperature were measured in the temperature range from 30°C to 180°C and the frequency range from 100 Hz to 1 MHz. For measurement electrical characteristic a new method was used, which implemented to automate the sampling and to enable measurement without a human factor. The software application is connected via USB communication to a microcontroller, which measures the temperature in the furnace. When the temperature reaches the defined value, the microcontroller sends information to the software application. Then the application through GPIB communication activates the LCR meter, which measures the defined parameters of the tested samples. Based on parameters such as dielectric constant (ε_r), tangent losses ($tan\ \delta$) and impedance, the characteristics of the tested samples were determined. Using the Curie-Weiss law and modified Curie-Weiss law, based on the measured values of the parameters, the Curie constant and the exponent of nonlinearity were determined.

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Evolution of structural and functional properties of the Fe/$BaTiO_3$ system under the influence of mechanochemical activation and heating treatment

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Powdery mixtures of 30 mass % Fe and 70 mass % $BaTiO_3$ were activated in the planetary ball mill within the time intervals of 30 min to 300 min. The activated powder was pressed under 392 MPa pressure, into disc-shaped samples with 8 mm diameter and thickness of 1.5 mm. The pressed samples of activated powder were sintered at the temperature of 1200 ^{0}C in the air atmosphere for two hours.

XRD analysis showed that with the rise of activation time, $BaTiO_3$ (110) reflection decreases in intensity, whereas the intensity of (200) reflection rises, with barium-titanate changing its crystallinity from orthorhombic and tetragonal to cubic symmetry due to the impact of the crystalline grains size, varying from 39 nm to 137 nm.

The system shows the highest relative content of Fe_2O_3 for 90 min activation time. Further increase in the activation time leads to a decrease in FeO and Fe_3O_4 content and the growth of pure iron content from $t_{activation}$ = 150 min. In the sample activated for 270 min, the Fe content reaches the highest relative value followed by the local maximum of 0.13% in microstrain value and the locally minimal dislocation density of 674 nm^{-2}, indicating the incorporation of iron from its oxide phases into the barium-titanate matrix.