The Serbian Society for Ceramic Materials
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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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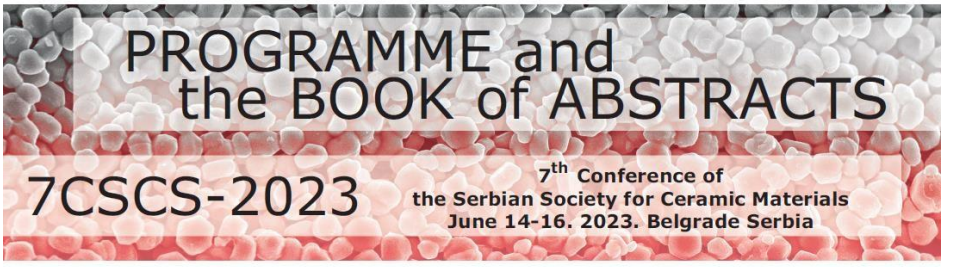

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O-19

TUNING OF FERROELECTRIC PROPERTIES OF $BiFeO_3$ CERAMICS BY CATION SUBSTITUTIONS AT Bi-SITE AND Fe-SITE

Aleksandar Radojković[1], Danijela Luković Golić[1], Nataša Jović-Orsini[2], Jovana Ćirković[1], Nenad Nikolić[1], Zorica Branković[1], Goran Branković[1]

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In this study, we tried various cation substitutions at Bi-site (La^{3+}, Eu^{3+}) and Fe-site (Nb^{5+}, Zr^{4+}**)** to explore their possible synergism and improvement of the ferroelectric properties of bismuth ferrite. The cations with higher valence ought to suppress the formation of structural defects during syntheses, such as oxygen and bismuth vacancies. These defects are responsible for high leakage currents and low breakdown voltages characteristic of pure $BiFeO_3$. On the other hand, rare earth cations at the Bi-site usually enable densification of the ceramics at a broader range of temperatures, preventing bismuth loss and formation of defects and secondary phases during sintering. However, dopant concentrations above 10–15 mol% may give rise to a transition from polar, rhombohedral (*R*3*c*) to non-polar, orthorhombic (*Pnma*) symmetry.

Thus, we synthesized pure and selected compositions doped $BiFeO_3$ by a hydro-evaporation method and determined the optimal calcination temperature by thermal analyses of the precursor powders. Then we characterized ceramics samples using X-ray diffraction (XRD) analysis, scanning electron microscopy (SEM) and polarization techniques. Although only 1 mol% Nb^{5+} decreased the leakage current, it surprisingly deteriorated the ferroelectric properties of $BiFeO_3$. Similar effect exhibited the samples containing Zr^{4+} that showed no improvement compared with undoped bismuth ferrite. On the contrary, La^{3+} and Eu^{3+} (incorporated at the Bi-site) improved the ferroelectric properties as their concentrations increased, whereby the samples doped with 15 mol% La exhibited higher remnant electric polarizations at observed electric fields. The highest remnant electric polarization of 31.9 μC/cm^2 at 150 kV/cm, was measured for $Bi_{0.85}La_{0.15}Fe_{0.998}Zr_{0.002}O_3$, indicating the synergetic effect of La^{3+} and Zr^{4+}, which is limited to low Zr^{4+} concentrations.