ENHANCED ELECTRICAL PROPERTIES OF CERAMICS THROUGH OXYGEN-ENRICHED HYDROTHERMAL SYNTHESIS

Căşuţ Cristian[1,2], Marinela Miclău[1], Catalin N. Marin[2], Ursu Daniel[1], Raul Bucur[1]

[1]National Institute for Research and Development in Electrochemistry and Condensed Matter, Plautius Andronescu Str., No. 1, 300224 Timisoara, Romania
[2]West University of Timisoara, Physics Faculty, V. Pârvan Ave., No. 4, 300223 Timisoara, Romania;
e-mail: cristian.casut95@e-uvt.ro

Abstract

Considering the vast range of potential uses and the possibility of intrinsic defect engineering in the perovskite structure, bismuth ferrite ($BiFeO_3$, BFO) is still being extensively researched. $BiFeO_3$ semiconductor defect control may offer an essential approach to overcome unwanted constraints, such as high leakage current, which is linked to the existence of oxygen vacancies (VO) and Bi vacancies (VBi). Our study proposes a hydrothermal method for the reduction of the concentration of V_{Bi} during of $BiFeO_3$ ceramic synthesis [1].

The low conductivity p-type $BiFeO_3$ ceramics have been achieved by utilizing hydrogen peroxide (H_2O_2) as part of the media. Hydrogen peroxide acted as the electron donor in the perovskite structure, controlling V_{Bi} in the $BiFeO_3$ semiconductor, which caused the dielectric constant and loss to decrease along with the electrical resistivity. When comparing the hydrothermally synthesized BFO ceramic, using a hydrogen peroxide-assisted method to two different BFO ceramics used as references, the reduction of Bi vacancies highlighted by FT-IR analysis (fig. 1a) had an expected contribution to the dielectric characteristic, decreasing the dielectric constant (fig. 1b) (with approximately 40%) and loss (fig. 1c) (three times), along with an increase in electrical resistivity (fig. 1d) (three times).

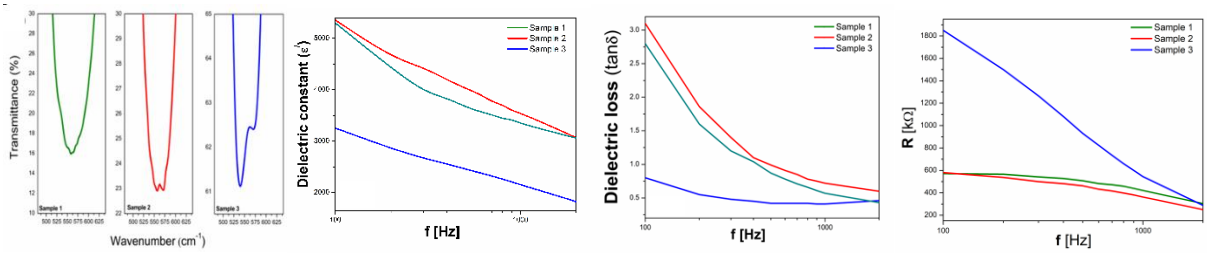

Fig.1 (a) FT-IR spectra of the samples in the range of 480 – 640 cm^{-1}; The frequency dependence of (b) the dielectric constant and (c) dielectric loss b) FT-IR spectra (d) electrical resistance

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References

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