Ceramics International

Volume 40, Issue 7 PART A, 2014, Pages 9225-9233

Solid solutions of La-doped $BiFeO_3$ obtained by the Pechini method with improvement in their properties (Article)

García-Zaleta, D.S.[a], Torres-Huerta, A.M.[b], Domínguez-Crespo, M.A.[b], Matutes-Aquino, J.A.[c], González, A.M.[d], Villafuerte-Castrejón, M.E.[e]

[a] Instituto Politécnico Nacional, **CICATA**-**Altamira**, Programa de Doctorado en Tecnología Avanzada, Km 14.5, Carretera Tampico-Puerto Industrial **Altamira**, 89600 **Altamira**, Tamps, Mexico

[b] Instituto Politécnico Nacional, **CICATA**-**Altamira**, Grupo CIAMS, Km 14.5, Carretera Tampico-Puerto Industrial **Altamira**, 89600 **Altamira**, Tamps, Mexico

[c] Centro de Investigación en Materiales Avanzados, S.C., CIMAV, Miguel de Cervantes 120, Complejo-Industrial Chihuahua, 31120, Mexico

[d] Universidad Politécnica de Madrid, Ctra. Valencia km 7, 28031 Madrid, Spain

[e] Universidad Nacional Autónoma de México, IIM, Ciudad Universitaria, México D.F. 04510, Mexico

Abstract

In this work, the synthesis of a series of solid solutions of $Bi_{1-x}La_xFeO_3$ (BLFO) ($0 \leq x \leq 0.15$) obtained by the Pechini method is reported. The effects of lanthanum concentrations on the phase formation, grain size, as well as electric and magnetic properties were studied. The XRD results displayed the single $BiFeO_3$ (BFO) phase for the different employed compositions. Crystal structure and cell parameters were refined by the Rietveld analysis, indicating that the obtained ceramics crystallized in the rhombohedral structure. The slight variation of the cell parameters and density values confirmed the partial substitution of Bi^{3+} by La^{3+} into the perovskite A site like $BiFeO_3$ structure. Scanning electron microscopy was used to obtain the morphology of the different synthesized compounds, revealing a diminution of the grain sizes during the sintering process, attributed to the increment of La^{3+} content. Electric impedance spectroscopy (EIS) measurements were performed to evaluate the electric properties, thus showing a notable increase in the permittivity. The effect of incorporating lanthanum into the BFO structure enhanced ferroelectric and ferromagnetic properties.

Author keywords

C. Electrical properties; C. Magnetic properties; Ceramics; X-ray diffraction