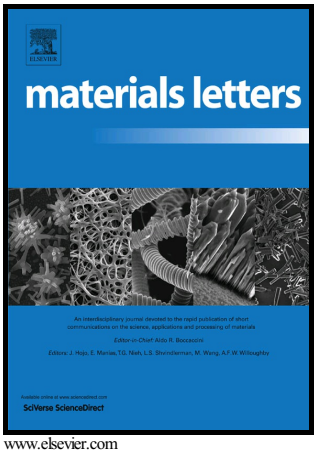

Effect of Nb doping on the morphology and Multiferroic behavior Of $Bi_{0.9}La_{0.1}FeO_3$ ceramics

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PII: S0167-577X(16)30120-3
DOI: http://dx.doi.org/10.1016/j.matlet.2016.01.120
Reference: MLBLUE20248

To appear in: *Materials Letters*

Received date: 7 October 2015
Accepted date: 24 January 2016

Cite this article as: V.A. Khomchenko and J.A. Paixão, Effect of Nb doping or the morphology and Multiferroic behavior Of $Bi_{0.9}La_{0.1}FeO_3$ ceramics *Materials Letters,* http://dx.doi.org/10.1016/j.matlet.2016.01.120

Effect of Nb doping on the morphology and multiferroic behavior of $Bi_{0.9}La_{0.1}FeO_3$ ceramics

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Synthesis and study of the crystal structure, microstructure, local ferroelectric, and magnetic properties of the $Bi_{0.9}La_{0.1}Fe_{1-x}Nb_xO_{3+x}$ ($x \leq 0.02$) perovskites have been carried out to shed light on the conditions underlying the appearance of doping-driven instability of the cycloidal antiferromagnetic order in the polar phase of bismuth ferrite. The light aliovalent substitution has not been found to change the rhombohedral symmetry specific to the parent $Bi_{0.9}La_{0.1}FeO_3$. It has been proven that the doping removes the cycloidal modulation characteristic of the rhombohedral phase to stabilize a weak ferromagnetic ferroelectric state. The antiferromagnetic-weak ferromagnetic transition is accompanied by a dramatic decrease in the average size of crystal grains and ferroelectric domains. The magnetic and morphological transformations can be understood by taking into consideration the charge-compensating mechanism involving the formation of lattice defects in the donor-doped materials. The observation of a correlation between the magnetic and morphological evolution in the $Bi_{0.9}La_{0.1}Fe_{1-x}Nb_xO_{3+x}$ series suggests that structural defects should be considered as an essential factor controlling the magnetic ground state in $BiFeO_3$-based multiferroics.

Keywords: $BiFeO_3$, Multiferroics, Lattice defects, Spin-cycloid instability, Ferroelectric domains

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