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Electrical and nonlinear current-voltage characteristics of La-doped BiFeO₃ ceramics

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Abstract

Multiferroic Bi_{1-x}La_xFeO₃ ($x = 0, 0.05, 0.1, 0.2, \text{ and } 0.3$) ceramics with particle sizes of ~67-19 nm were prepared by a simple co-precipitation method. The effects of La dopant on the microstructure, giant dielectric response, and electrical properties were investigated. The grain size of Bi_{1-x}La_xFeO₃ ceramics significantly decreased with increasing La doping ions. The Bi_{0.95}La_{0.05}FeO₃ ceramic exhibited the highest leakage current density value. Interestingly, it strongly decreased as the concentration of La increased. The nonlinear coefficient of La doped BFO slightly decreased with increasing La. This shows a space-charge-limited conduction mechanism, which is involved in low electric field regions for all samples investigated. La substitution significantly enhanced the breakdown field. It was found that the potential barrier height at the grain boundary was slightly reduced from 0.3 to 0.16 eV by substitution of La ions. Using impedance spectroscopy analysis, except for the Bi_{0.7}La_{0.3}FeO₃ ceramic, the grain

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