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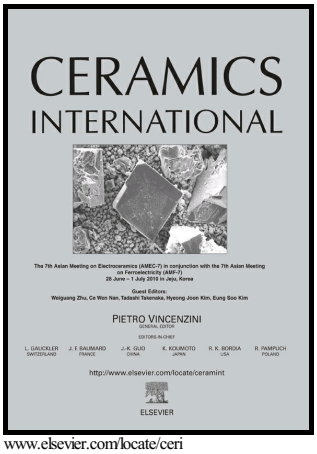

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The decrease of depolarization temperature and the improvement of pyroelectric properties by doping Ta in lead-free $0.94Na_{0.5}Bi_{0.5}TiO_3$-$0.06BaTiO_3$ ceramics

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Abstract

Ta-doped lead-free 0.94NBT-0.06BT-xTa (x = 0.0 – 1.0 %) ceramics were synthesized by a conventional solid-state route. XRD shows that the compositions are at a morphotropic phase boundary where rhombohedral and tetragonal phases coexist. The depolarization temperature (T_d) shifted to lower temperature with the increase of Ta content. The pyroelectric coefficient (p) of doped ceramics greatly enhanced compared with undoped material and reached a maximum of 7.14 x10^{-4} C.m^{-2}. $^{\circ}C^{-1}$ at room temperature (*RT*) and 146.1 x10^{-4} C.m^{-2} $^{\circ}C^{-1}$ at T_d at x = 0.2%. The figure of merits, F_i and F_v, also showed a great improvement from 1.12 x10^{-10} m.v^{-1} and 0.021 m^2.C^{-1} at x = 0.0 to 2.55 x10^{-10} m.v^{-1} and 0.033 m^2.C^{-1} at x = 0.2% at RT. Furthermore, F_i and F_v show the huge improvement to 52.2 x 10^{-10} m.v^{-1} and 0.48 x10^{-10} m.v^{-1} respectively at T_d at x = 0.2%. F_C shows a value between 2.26 to 2.42 x10^{-9} C.cm^{-2}. $^{\circ}C^{-1}$ at RT at x= 0.2%. The improved pyroelectric properties make NBT-0.06BT-0.002Ta ceramics a promising infrared detector material.

Keywords*: Lead free ceramics; Lanthanum doping NBT-BT; Morphotropic phase boundary (MPB); Depolarization temperature; Pyroelectric properties; Figure of merits.*

1. *Introduction*

Lead-free ceramics have been investigated heavily as a response to the legislations of the RoHS (restriction of use of certain hazardous substances) and the WEEE (waste electrical and electronic equipment) systems in the European Union and many other countries [1].

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