

Growth of ZnO nano-grains through Bismuth-Zinc-Niobium Pyrochlore ceramics via Co-doping

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Abstract

The effects of Co doping on structural properties of $\text{Bi}_{1.5}\text{Zn}_{0.92}\text{Nb}_{1.5}\text{O}_{6.92}$ (BZN) Pyrochlore ceramics have been investigated. Co atoms were substituted into pure samples in accordance to three types of composition, $\text{Bi}_{1.5}\text{Zn}_{0.92}\text{Nb}_{1.5-x}\text{Co}_x\text{O}_{6.92-x}$ for $x = 0.03, 0.04$, $\text{Bi}_{1.5}\text{Zn}_{0.92}\text{Nb}_{1.5-3x/5}\text{Co}_x\text{O}_{6.92}$ and $\text{Bi}_{1.5}\text{Zn}_{0.92}\text{Nb}_{1.5-x}\text{Co}_x\text{O}_{6.92-x} + (\text{Bi}_{1.5}\text{Zn}_{0.46})(\text{Zn}_{0.46-3x/6}\text{Nb}_{1.5-3x/5}\text{Co}_x)\text{O}_{6.92-x/2}$ for substitution of ZnO . The structural analysis of $\text{Bi}_{1.5}\text{Zn}_{0.92}\text{Nb}_{1.5-x}\text{Co}_x\text{O}_{6.92-x}$ revealed that the single phase of pyrochlore can be obtained for $x = 0.03$ and 0.04 only. Further increasing of Co content caused a second phase of ZnO appearance and its amount increased as doping increase. Co doping affects the lattice constant and degree of texturization but has no effects on the BZN grain size. The grain size of the single phase pyrochlore was found to be doping independent and of the order of 66 nm. To understand the dramatically changes associated with the appearance of ZnO, detailed structural analysis were handled. The ZnO hexagonal phase grows systematically on the BZN creating grains that exceed in size that of the pyrochlore at high x ratios.

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