Investigation of structural and dielectric properties of subsolidus bismuth iron niobate pyrochlores

ABSTRACT

Subsolidus $Bi_{3.36}Fe_{2.08+x}Nb_{2.56-x}O_{14.56-x}$ (BFN) pyrochlores prepared by solid-state reaction at 950°C over 48 h showed a moderate solid solution range of $-0.24 \leq x \leq 0.48$. As to preserve the overall charge electroneutrality of the system, the doping mechanism was proposed to be a one-to-one substitution of Nb^{5+} by Fe^{3+} together with oxygen non-stoichiometry, i.e. $Nb^{5+} \leftrightarrow Fe^{3+} - O^{2-}$. BFN pyrochlores crystallized in a cubic symmetry, space group Fdm (No. 227), Z = 4 and their refined lattice constants were found to be in the range 10.5071 (4)–10.5107 (7) Å. The microstructural analyses revealed their grain size range 0.5–8.4 μm and crystallite size range 63−78 nm, respectively. These thermally stable BFN pyrochlores exhibited moderate high dielectric constants, ε' in the range 141–150 and dielectric losses, $\tan \delta \sim 0.2$ at ~30°C and 1 MHz.

Keyword: Pyrochlores; Solid-state method; Electrical properties; Niobate compounds