Subsolidus solution and electrical properties of Sr-substituted bismuth magnesium niobate pyrochlores

ABSTRACT

Here we investigated the structural and dielectric properties of (Bi3.36Mg0.64-xSrx)(Mg1.28Nb2.72)O13.76 (0Ò xÒ0.5) subsolidus solution. Sr-substituted bismuth magnesium niobate (BMSN) pyrochlores were prepared by solid-state reaction at 1025 °C over 1ï 2 days. X-ray diffraction (XRD) analysis confirmed that the BMSN pyrochlores crystallise in cubic symmetry, space group Fd3m with lattice parameters in the range 10.5968 (4)-10.5671 (17) Å. The surface morphologies of these samples, as confirmed by Scanning Electron Microscopy (SEM), were composed of irregular shaped grains. Both Scherrer and Williamson-Hall methods revealed that the crystallite sizes were in the range 46ï 75 nm. No thermal event was discernible over the temperature range 30ï 1000 °C, thus confirming the thermal stability of these materials. On the other hand, Arrhenius conductivity plots showed the BMSN pyrochlores to be highly insulating with activation energies of ~1.20ï 1.49 eV. At ~30 °C and 1 MHz, BMSN pyrochlores exhibited moderate high bulk dielectric constants, ὐô, 90ï 186 and low dielectric losses, tan ŭ in the order of 10ī 2ï 10ī 1, respectively. Both the ὐô and tan ŭ values of the BMSN pyrochlores showed a nearly two-fold decrease with increasing Sr concentration. Negative temperature coefficient of capacitances, TCC, ī 408 to ī 713 ppm/°C were recorded over ~30ï 300 °C at 1 MHz.

Keyword: Pyrochlore; Niobate compounds; Dielectric constants; Dielectric losses