Structural and electrical properties of bismuth magnesium tantalate pyrochlores.

Abstract

The subsolidus cubic pyrochlore phases in the Bi2O3–MgO–Ta2O5 (BMT) system were prepared with the proposed formula, $Bi^{3+}_{(5/2)x}Mg^{2-}_{x}Ta^{3-}_{(3/2)x}O^{14-}_{x}$ ($0.12 \leq x \leq 0.22$). Replacement of smaller cations, Mg^{2+} and Ta^{5+} by larger Bi^{3+} cations with considerable oxygen non-stoichiometry within structure was proposed. The synthesised samples were confirmed phase pure by X-ray powder diffraction and their refined lattice parameters were in the range of 10.5532(4)–10.5672(9) Å. The grain sizes of the samples determined by SEM analysis were in the range of 0.6–10.60 μm and their average relative densities were more than 80%. Five infrared-active modes were also observed in their FTIR spectra due to their metalsingle bondoxygen bonds. The BMT pyrochlores were highly electrical resistive with high dielectric constants, ε' in the range of ~70–85; dielectric losses, tan δ in the order of 10^{-3} at frequency 1 MHz and a negative temperature coefficient of permittivities, $TC\varepsilon'$ of ~−158 to −328 ppm/°C.

Keyword: C. Dielectric properties; D. Tantalates; Pyrochlores; Ceramics.