**Doping mechanisms and electrical properties of bismuth tantalate fluorites**


ABSTRACT

Phase-pure bismuth tantalate fluorites were successfully prepared via conventional solid-state method at 900 °C in 24–48 h. The subsolidus solution was proposed with the general formula of Bi3+x Ta1−x O7−x ($0 \leq x \leq 0.184$), wherein the formation mechanism involved a one-to-one replacement of Ta5+ cation by Bi3+ cation within ~4.6 mol% difference. These samples crystallised in a cubic symmetry, space group Fm-3 m with lattice constants, a = b = c in the range 5.4477(± 0.0037)–5.4580(± 0.0039) Å. A slight increment in the unit cell was discernible with increasing Bi2O3 content, and this may attribute to the incorporation of relatively larger Bi3+ cation in the host structure. The linear correlation between lattice parameter and composition variable showed that the Vegard's law was obeyed. Both TGA and DTA analyses showed Bi3+x Ta1−x O7−x samples to be thermally stable as neither phase transition nor weight loss was observed within ~28–1000 °C. The AC impedance study of Bi3TaO7 samples was performed over the frequency range 5–13 MHz. At intermediate temperatures, ~350–850 °C, Bi3+x Ta1−x O7−x solid solution was a modest oxide ion conductor with conductivity, ~10−6–10−3 S cm−1; the activation energy was in the range 0.98–1.08 eV.



**Keyword:** Bi3TaO7; Bi3+x Ta1−x O7−x; Electrical properties; Doping mechanisms