Subsolidus phase equilibria and electrical properties of pyrochlores in the Bi_2O_3–CuO–Ta_2O_5 ternary system

ABSTRACT

Subsolidus phase relations had been determined for the Bi_2O_3–CuO–Ta_2O_5 (BCT) system over the temperature range 700–950 °C in air. Two structurally distinct ternary phases of different symmetries, a cubic pyrochlore and a monoclinic zirconolite were observed. Phase-pure pyrochlores existed in a unique boomerang-shaped area, which could be described using the general formula, $Bi_{2.48+y}Cu_{1.92-x}Ta_{3.6+x-y}O_{14.64+3x/2-y}$: $0.00(1) \leq x \leq 0.80(1)$ and $0.00(1) \leq y \leq 0.60(1)$, respectively. BCT subsolidus pyrochlores exhibited low electrical conductivities, 10^{-7}–10^{-6} S cm^{-1}, moderate dielectric constants, ε', ~60–80 and low dielectric losses, $\tan\delta$, ~0.01–0.20 at 1 MHz and ambient temperature, ~28 °C. The recorded low activation energies, 0.32–0.40 eV suggesting these electroceramics were of semiconductor-type at elevated temperatures.

Keyword: Ternary phase diagram; X-ray methods; Electrical conductivity; Tantalates