Phase equilibria and electrical properties of pyrochlore and zirconolite phases in the Bi2O3-ZnO-Ta2O5 system.

ABSTRACT

The complete subsolidus phase diagram of the system Bi2O3–ZnO–Ta2O5, including cubic pyrochlore and monoclinic zirconolite phases, has been determined at 950–1050 °C. Through systematic heat treatment and X-ray diffraction of over 100 compositions, the layout of compatibility triangles (both 2-phase and 3-phase) and single phase solid solution areas has been determined. Pyrochlore and zirconolite phases have ideal nominal compositions Bi1.5Zn1.0Ta1.5O7 and Bi2(Zn1/3Ta2/3)2O7 respectively, but both form solid solution areas. The sintering condition of pyrochlore pellets has been optimised to obtain high density ceramics with minimal weight loss: optimised condition is 1100 °C for pellets covered with sacrificial powder. Permittivity, ε′ dielectric loss and temperature coefficient of capacitance, TCC, of single phase materials were measured using impedance spectroscopy; ε′ and TCC show little variation with composition but the losses are higher for Zn-deficient compositions.

Keyword: Powder solid-state reaction; Sintering; X-ray methods; Electrical properties.