

Reaction study and phase formation in Bi₂O₃-ZnO-Nb₂O₅ ternary system

ABSTRACT

The formation of two structurally related phases; cubic pyrochlore and monoclinic zirconolite in Bi₂O₃-ZnO-Nb₂O₅ (BZN) ternary system was investigated. Phase pure Bi₄Zn_{4/3}Nb_{8/3}O₁₄ synthesized via conventional solid state methods at 950°C was refined and fully indexed with space group C2/c; lattice parameters, $a = 13.1109(3)$ Å, $b = 7.6764(2)$ Å, $c = 12.1528(2)$ Å and $\beta = 90^\circ$ and $\gamma = 101.33^\circ$, respectively. Reaction study revealed that Bi₅Nb₃O₁₅ and BiNbO₄ phases are two important precursors that react with ZnO at higher temperatures during phase formation. The pyrochlore does not form at the conventionally predicted composition Bi₄Zn_{4/3}Nb_{8/3}O₁₄, which falls in the zirconolite region. Instead, cubic pyrochlore forms at substantially lower Bi concentrations in BZN system. The two interrelated areas, a trapezoidal cubic pyrochlore subsolidus, and a rectangular shaped monoclinic zirconolite subsolidus serve to confirm the data consistency over various phase assemblages and compatibility in the phase diagram.

Keyword: Diagram; Pyrochlores; Monoclinic zirconolite; Subsolidus