
Cobalt oxide doped zinc-boron-phosphate glasses, preparation and properties

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Abstract

Boron-phosphate glasses combine the properties of phosphate glasses such as high solubility for rare-earth ions and excellent optical properties with the high thermal, chemical and mechanical properties introduced by boron oxide [1]. The obtaining and properties of boron-phosphate glasses doped with cobalt oxide are investigated in this work. The glass was prepared by classical melting-quenching method but using the wet preparation of raw materials [1]. The amount of CoO was of 0.5 and 3.0 mol% and the melting temperature of 1300 °C for 2h. UV VIS transmittance shows a minimum in the domain of 500-700 nm. The FTIR maxima are attributed to the stretching vibrations of the P-O-P bonds in units Q2 and Q1 at 770 and 870-890 cm⁻¹ respectively and to the symmetrical and asymmetrical stretching of the PO₃²⁻ units at 1030 and 1220 cm⁻¹, respectively. The vibrations of O3B-O-BO4 bonds can be identified at 770 cm⁻¹ and asymmetric vibrations of O3B-O-B-O bonds in triangular borate units (BO3 and BO2O-) from piro and orthoborate groups at 1030 cm⁻¹. The mechanical properties, hardness (H), Young's modulus (E) and fracture toughness (KIC) of boron phosphate glasses, evaluated by micro- and nanoindentation techniques, showed higher values than those for alumino-phosphate glasses. DSC analyze of samples thermal treated at 800 and 900 °C indicates the crystallization temperatures around 660 and 790°C for the XRD identified crystalline compounds Al(PO₃)₂ and BPO₄. The magnetic susceptibility values lies between 1.8 x 10⁻⁵ emu / g / Oe and 9.5 x 10⁻⁵ emu / g / Oe, directly proportional to Co oxide concentration.

References

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