Coloration of alkali borate glasses by transition d and f elements: a review

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Abstract

The presence of transition elements in alkali borate glasses is at the origin of one of the most noticeable chemical dependence of the color of oxide glasses. We compare the chemical dependence of optical absorption data on borate glasses containing Cr, Co , Ni, Cu and U. Alkali concentration in borate glasses cause an important modification in the speciation of transition elements, with major modifications observed when IIIB is present, i.e. at concentrations lower than 20 mol%. The variations of coordination numbers, crystal-field splitting, site distribution or site geometry depend on the existence of either only one or several sites occupied by the transition element. These spectroscopic properties will be discussed at the light of recent findings on the medium-range organization in borate glasses, in particular on the role played by IIIB in the geometry of borate super-units. The local rigidity induced by planar IIIB triangles also explains the formation of ordered element clusters, already demonstrated by EXAFS and XANES in low-alkali borate glasses containing Ni, Co or Zn.

Keywords: glass color, transition elements, borate glasses, optical spectroscopy

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