Synthesis and physical properties of glasses in the Sb_2O_3–$PbCl_2$–MoO_3 system

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Abstract

Lead chloroantimonite glasses form stable binary glasses that may accommodate numerous oxides or halides as a third component. Molybdenum trioxide is a glass progenitor leading to molybdate glasses. Ternary glasses have been synthesized and studied in the Sb_2O_3–$PbCl_2$–MoO_3 system. Compositional limits of glass formation are reported and two series of glass samples have been prepared corresponding to the general formulas: $(90 - x)Sb_2O_3$–$xPbCl_2$–$10MoO_3$ and $(90 - x)Sb_2O_3$–$xMoO_3$–$10PbCl_2$. Glass transition temperature is close to 290 °C at high Sb_2O_3 content and decreases as antimony oxide is substituted by MoO_3 or $PbCl_2$. Position, width and intensity of crystallization peak suggest that devitrification rate is small in some composition ranges. The evolution of density, thermal expansion, refractive index and microhardness has been studied as a function of composition parameter x. Deviations from linearity are observed. They suggest structural changes in the case of the MoO_3/$Sb2O_3$ substitution while it appears that molar volume increases linearly versus lead content in the other series of glasses. Refractive index is close to 2.04. Optical transmission ranges from 550 nm in the visible spectrum to 5.5 μm in the infrared. It is limited by extrinsic absorption bands arising from hydroxyls and silicon impurities. Young's, bulk and shear moduli have been measured for the two series of samples.

Keywords: Oxychloride glass; Antimony oxide; Physical properties; Elastic modulus.