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Spectroscopic property and color of bismuth silicate glasses with addition of 3d transition metals

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Abstract

This research focuses on optical properties of bismuth silicate based glasses. The glasses with the composition $60\text{SiO}_2\text{-}40\text{Bi}_2\text{O}_3$ were prepared and 3d transition metals (Cr, Mn, Fe, Co, Ni and Cu) with 0.1, 0.3, 0.5 and 1 at% were added. Optical spectra in terms of transmittance were used to analyze color shade with CIELab analysis in all glasses. Transmittance of glasses was changed in intensity and dominant wavelength when the transition metals were incorporated. This resulted in the change of lightness and color shade or CIELab values. Localization of 3d transition metals resulted in change of optical properties by non-bridging oxygen ions, which acted as network modifier.

Keywords: Optical materials and properties; Bismuth silicate glass; 3d transition metals; CIELab

1. Introduction

Bismuth silicate glasses can be used in a lot of industrial and special applications as materials for low loss fiber optics, IR transmitting materials or as active media of Raman optical amplifiers [1]. In this work, the composition of 60 mol% silica and 40 mol% bismuth oxide ($60\text{SiO}_2\text{-}40\text{Bi}_2\text{O}_3$) was selected to produce bismuth silicate glasses because it has congruent melting and the mixture can be

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