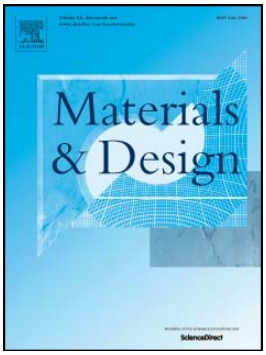

Structure and optical band gap study of transparent oxyfluoride glass-ceramics containing CaF_2 nanocrystals

M. Rezvani, L. Farahinia

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Structure and optical band gap study of transparent oxyfluoride glass- ceramics containing CaF_2 nanocryastals

M. Rezvani[1]* and L. Farahinia

[1] Department of Materials Science and Engineering, University of Tabriz, Tabriz, Iran

*Corresponding Author

Email: m_rezvani@tabrizu.ac.ir

Tel: +989144159511

Fax: +984133362282

Oxyfluoride glass- ceramics containing CaF_2 nanocrystals were prepared by one-step crystallization of SiO_2- Al_2O_3- CaO- CaF_2 glasses at different temperatures. X- ray diffraction (XRD) results have revealed that CaF_2 was the only precipitated crystalline phase in glass-ceramic samples. Fourier transform infrared spectroscopy (FT-IR) study of the samples showed the effect of crystallization temperature on the structure. According to DTA and XRD results, suitable glass and its associated glass- ceramics were selected as the best sample in order to study the effect of crystallization on the optical properties. UV- Vis spectra of samples were recorded to determine optical properties. Fermi energy level decreased for glass- ceramics due to the increment of semiconducting behavior. Urbach energy, optical band of the specimens have been reduced by increasing of nanocrystals in glassy matrix which could be attributed to increasing of the order of the structural and formation of crystals and dangling bonds, respectively.

Keywords oxyfluoride; CaF_2 nanoctystal; Band gap; Urbach energy

1. Introduction

Fluoride glasses are attractive materials for photonic applications due to their high transparency and low phonon energies [1-2]. However, low thermal, chemical and mechanical properties of them are undeniable [3-4]. Although oxide glasses have high phonon energies, they have more stability and better mechanical properties [5-6]. Hence, there were attempts to combine advantages of both fluoride and oxide glasses. In that sense, glasses containing both fluorine and oxygen, called oxyfluoride glasses, have solved the problem to some extent. In other words, introduction of oxygen to fluoride glass increases the stability and affects the glass formation and the structure of glass networks [7-9].