

Effect of heat treatment temperature to the crystal growth and optical performance of Mn_3O_4 doped $\alpha\text{-Zn}_2\text{SiO}_4$ based glass-ceramics

ABSTRACT

In this work, manganese (II, III) oxide, (Mn_3O_4) doped zinc soda lime silica glasses have been synthesized using a conventional melt-quenching process and followed by control heat treatment process. The crystal phase composition and optical properties of $\alpha\text{-Zn}_2\text{SiO}_4\text{:Mn}_3\text{O}_4$ based glass-ceramics are comprehensively studied. The physical properties and crystal growth of $\alpha\text{-Zn}_2\text{SiO}_4$ phase were measured by density analysis, linear shrinkage, X-ray diffraction (XRD) and Fourier transform infrared reflection (FTIR) spectroscopy. From the measurement, the average density and linear shrinkage of $\alpha\text{-Zn}_2\text{SiO}_4\text{:Mn}_3\text{O}_4$ based glass-ceramics increased with increasing heat treatment temperature. Besides, the presence of Zn–O–Si bands indicates the formation of $\alpha\text{-Zn}_2\text{SiO}_4$ crystal phase and causing the decrement of energy band gap. The photoluminescence spectra of Mn^{2+} ions exhibit emission transitions of ${}^4\text{T}_1(\text{G})\text{--}{}^6\text{A}_1(\text{S})$ and show a prominent green emission colors of $\alpha\text{-Zn}_2\text{SiO}_4$ phase at 524 nm

Keyword: $\alpha\text{-Zn}_2\text{SiO}_4$; Glass-ceramic; Phosphor; Crystal growth; Optical properties