

Influence of zinc oxide on the physical, structural and optical band gap of zinc silicate glass system from waste rice husk ash

ABSTRACT

Zinc silicate (ZnO-SiO_2) glass was fabricated using melt-quench technique with compositions according to the empirical formula $[(\text{ZnO})_x(\text{WRHA})_{1-x}]$ which $x = 0.50, 0.55, 0.57$ wt.%. These glass series acquire zinc oxide (ZnO) and white rice husk ash (WRHA) as silica source with two different melting temperatures of $1450\text{ }^\circ\text{C}$ and $1500\text{ }^\circ\text{C}$. Temperature of $1450\text{ }^\circ\text{C}$ and $1500\text{ }^\circ\text{C}$ were chosen in this study because the lowest melting point of ZnO-SiO_2 were at $1475\text{ }^\circ\text{C}$ and by choosing a temperature within the range of $1475\text{ }^\circ\text{C}$ a conclusive study on the best melting point using WRHA substituents can be done. Physical, structural and optical characteristics of fabricated glass samples were analyzed using Energy Dispersive X-ray Fluorescence (EDXRF), X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR) and UV-vis (UV-vis). Optical band gap of the system was obtained by approaching the optical absorption techniques from the Mott-Davis methods. Results indicate that ZnO-SiO_2 glass samples emerge in favors of direct and indirect forbidden transition and increase in ZnO causes a higher absorption thus resulting in lower band gap. Last but not least, in this study based on the increase of ZnO content, the glass samples which contains a higher amount of ZnO has a higher band gap as Zn^{2+} ions reacts as good network modifier in the glass structure and formed a better arrangement and structure compared to system which has less network modifier.

Keyword: Glasses; Zinc oxide; Structural properties; Optical properties; Optical band gap