

X-ray photoelectron spectroscopy (XPS) and gamma-ray shielding investigation of borosilicate glasses contained alkali/alkaline modifier.

ABSTRACT

In the present work, seven glass samples have been prepared utilizing melt-quenching method with composition of 40B₂O₃-10SiO₂-10Al₂O₃-30ZnO-10 (Li₂O/Na₂O/K₂O/MgO/CaO/SrO/BaO) all in mol%. Scanning electron microscope (SEM) and Energy-dispersive X-ray spectroscopy (EDX) have characterized for H3 (K₂O) and H7 (BaO), to examine the structural properties. X-ray Photoelectron Spectroscopy (XPS) has shown that the boron (B) element composition is highest after oxygen elements in all the glasses. It has been also observed that incorporation of potassium (K) and strontium (Sr) elements are maximum compared to the other doped elements into the glass. Further, the photon shielding for H1-H7 samples were also studied. We calculated the mass attenuation coefficients (μ/ρ) for the present samples at some energies between 0.015 and 10 MeV. The results revealed that H7 (BaO) sample owns the highest μ/ρ values followed by H6 (SrO) while H1 (Li₂O) has the lowest μ/ρ . Moreover, H7 and H6 samples have higher effective atomic number than the rest of glasses. H7 sample has excellent shielding properties when compared with the other glasses. We found that the composition of the sample affects the attenuation of the glasses and high attenuation can be achieved when we used heavy metal oxides (such as BaO).

Keyword : X-ray photoelectron spectroscopy; Borosilicate glasses; Radiation; Attenuatio.