Comprehensive study on physical, elastic and shielding properties of ternary BaO-Bi2O3-P2O5 glasses as a potent radiation shielding material

ABSTRACT

Recent research studies have been carrying out to characterize the structural, elastic and shielding properties of novel ternary BaO-Bi2O3-P2O5 glasses. The glass series having composition BaO·(50 − x) Bi2O3·50P2O5 ($10 \leq x \leq 40$ wt%) were prepared by conventional melt-quenching technique and the variation in density (ρ), molar volume (Vm), X-ray diffraction (XRD) and ultrasonic velocities has also been studied and correlated with the structural modifications in the glasses. The shielding parameters, effective atomic numbers, half value layers, and exposure buildup factor values have been computed using WinXCom program and G-P fitting method. The variations of shielding parameters were discussed for the effect of Bi2O3 addition into the glasses. The density, ultrasonic velocity and the calculated elastic moduli are found to be composition dependent and discussed in terms of Bi2O3 modifiers. The replacement of BaO by Bi2O3 causes an increase in effective atomic number, while the half value layer and the exposure buildup factor are decreased. This indicates that the increment in the content of Bi2O3 improves the gamma ray shielding characteristics.

Keyword: Phosphate glass; Elastic properties; Half value layer; Shielding; WinXCom program