Stuctural, optical and radiation shielding properties of zinc boro-tellurite alumina glasses.

ABSTRACT

In this work, boro-telluride glasses with additional zinc, aluminum, and alkali–alkaline modifiers have been synthesized using the melt-quenching–annealing method. Six glasses were fabricated with composition of [(60 − x)B_2O_3–(10 + x)TeO_2–10ZnO–10Al_2O_3 5Li_2O–5MgO] all in mol% and x varied from 0, 10, 20, 30, 40 and 50. The aim of this work is to understand the effect of changing the main glass former from B_2O_3 → TeO_2, to obtain new optical materials. To confirm the amorphous nature of these six glasses, X-ray diffraction was characterized for all six glasses from 10° to 80°. Optical absorption with wavelength range 200–800 nm in room temperature was measured, and the optical absorption coefficient α(λ) calculated to obtain the cutoff wavelength. In addition, gamma photons shielding features of the prepared K1–K6 glasses were evaluated by means of some essential parameters such as mass attenuation coefficients (μ/ρ) and effective atomic number (Zeff) at five energies between 0.356 and 1.33 MeV. No significant difference between the theoretical and simulation μ/ρ values was found. The effective atomic number results indiacte that as the TeO_2 content increases, the photons' attenuation increases. The number of interactions of gamma photons with K6 sample (which contains the maximum amount of TeO_2) is relatively high (in comparison to the rest of the samples), which results in more attenuation and thus better shielding features for K6.

Keyword : Alkali metal compounds; Alkaline earth metal compounds; Aluminium compounds; Boron compounds; Chalcogenides; Data; Electromagnetic radiation.