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RESEARCH

Effects of TeO_2 and B_2O_3 on photon, neutron, and charged particle transmission properties of Bi_2O_3-BaO-LiF glass system

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Abstract

This work investigates the effects of TeO_2 and B_2O_3 on photon, neutron, and charged particle transmission properties of Bi_2O_3-BaO-LiF glass system. Photon transmission parameters were obtained via narrow beam setup simulation via FLUKA and those obtained from experimentally proved XCOM calculations. The attenuation factors of $\left(\mu/\rho\right)_{IS}$ and $\left(\mu/\rho\right)_{PP}$ control the value of μ/ρ at energies greater than 1.5 MeV; however, the region of influence differs for both absorption processes. While $\left(\mu/\rho\right)_{IS}$ peaks occur at 3 MeV, the influence of $\left(\mu/\rho\right)_{PP}$ becomes appreciable at E > 5 MeV. The values of linear attenuation factor (μ) ranged from 0.2119–0.5283, 0.2085–0.5248, 0.1837–0.4676, 0.1639–0.4223, 0.1519–0.3971, 0.1370–0.3638, and 0.1222–0.3315 cm^{-1} as B_2O_3 increased from 0 to 60 mol % with step of 10, respectively. The spectra of projected range (R) of the ions and CSDA range of electrons show that the TSP of electrons in the glasses increases as B_2O_3 increased from 0 to 60 mol % for energy lower than 5 MeV; however, it reverses at 10 MeV. The ability of the present glass system for stopping the transmission of various radiation beams reveals its potential use for shielding applications in medical and nuclear facilities.

Keywords Glass system · Synthesis · FTIR · Neutron transmission · Charged particle