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Elastic moduli, photon, neutron, and proton shielding parameters of tellurite bismo-vanadate (TeO_2–V_2O_5–Bi_2O_3) semiconductor glasses

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ABSTRACT

In this research, elastic moduli, photon, neutron, proton, and alpha particle shielding parameters for tellurite bismo-vanadate (TeO_2–V_2O_5–Bi_2O_3) were estimated and theoretically presented. Makishima–Mackenzie's (M-M) model and Phy-X/PSD software were used to achieve the required calculations. Young's modulus varied from 72.68 to 59.41 GPa while shear modulus varied from 28.75 to 23.66 GPa. Bulk modulus changed from 51.34 to 40.51 GPa, while Poisson's ratio changed from 0.264 to 0.255. The trend of the projected range for alpha and proton particles follows the order: $(TVB00)_{Range}$ > $(TVB05)_{Range}$ > $(TVB10)_{Range}$ > $(TVB15)_{Range}$ > $(TVB20)_{Range}$ > $(TVB25)_{Range}$. The mass attenuation coefficient of the TVB glasses follows the order: $(TVB00)\mu_m$ < $(TVB05)\mu_m$ < $(TVB10)\ \mu_m$ < $(TVB15)\ \mu_m$ < $(TVB20)\ \mu_m$ < $(TVB25)\ \mu_m$ at all energies. The MFP follows a similar trend as HVT, where TVB00 glass has the highest MFP and HVT among the considered glasses. The lowest range of Z_{eff} was achieved TVB00 glass and the highest for TVB25 glass. The *f*-factor of the TVB-glasses were almost equal due to similar number of electrons per unit mass. The variations in buildup factors with photon energy were identical for all glass materials and penetration depth (mfp). Results revealed that the inclusion and increase of Bi in the TVB-glass systems improves its radiation shielding capacity.