

Germanate oxide impacts on the optical and gamma radiation shielding properties of TeO₂-ZnO-Li₂O glass system

ABSTRACT

In this work, a series of tellurite glass combined with various concentrations of germanium oxide was fabricated according to the formula of $(70-x)\text{TeO}_2-x\text{GeO}_2-20\text{ZnO}-10\text{Li}_2\text{O}$ where $x = 5, 10, 15$ and 20 mol% via utilizing the melt-quench method for possible use in a radiation shielding applications. X-ray diffraction and Attenuated Total Reflectance Fourier Transform Infrared was employed to investigate the structure of the synthesized glasses. The density and Poisson's ratio for current samples reduced gradually from $5.221-5.008 \text{ g.cm}^{-3}$ and $0.134-0.131$, respectively, while the enhancement in bandgap values from $3.700-3.872 \text{ eV}$ with addition of GeO_2 is observed. The linear attenuation coefficient values at 0.015 MeV are 230.123 and 236.832 cm^{-1} for samples TG1 and TG4, respectively. Moreover, the lowest half-value layer attained via TG1 and raises from 0.0030 to 3.6684 cm while the highest HVL attained by TG4 and raises from 0.0029 to 3.9696 cm .

Keyword: Tellurite glasses; Germanate; XRDFITR; Optical absorption; Radiation shielding