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# Simulation of the X-ray and gamma-radiation shielding parameters of the Li2O+Sb2O3+PbO+GeO2 glass materials in the 20 - 300 keV energy range using Phy-X/PSD, XCOM, and Geant4 software programs

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Ionizing radiation is used in fields such as medical physics and nuclear research, with concrete and lead commonly serving as shielding materials. However, these materials carry health risks: lead is linked to harmful health effects, while concrete is heavy and susceptible to cracking over time, which raises safety concerns. Additionally, both lead and concrete block visible light, leading to a lack of transparency. Glass emerges as a suitable alternative, being cost-effective, transparent, and free from adverse health effects. In this study, the software programs Phy-X/PSD, Geant4, and XCOM have been employed to investigate the effect of chromium oxide (Cr<sub>2</sub>O<sub>3</sub>) on the radiation-shielding properties of glass systems with the chemical composition 10Li<sub>2</sub>O+(30-x)Sb<sub>2</sub>O<sub>3</sub>+20PbO+40GeO<sub>2</sub>+xCr<sub>2</sub>O<sub>3</sub></su where x = 0.1, 0.2, 0.3, 0.4, 0.5 mol%. The key properties examined include the linear attenuation coefficient (LAC), mass attenuation coefficient (MAC), mean free path (MFP), half value layer (HVL), tenth value layer (TVL), and effective atomic number (Zeff). These parameters were investigated for energies ranging from 20 to 300 keV. The results show that increasing the Cr<sub>2</sub>O<sub>3</sub> content enhances the shielding properties of the examined glass systems. The analysis indicates that the sample with the highest Cr<sub>2</sub>O<sub>3</sub> content exhibits the highest LAC and MAC, alongside the lowest HVL, TVL, and MFP, suggesting it offers better radiation shielding capabilities compared to the other samples. Furthermore, the shielding effectiveness of the glass samples was compared to literature data, focusing on the MFP at 100 keV and 200 keV. The findings reveal that the MFP of our samples is lower than that of other reported glass materials, suggesting that the glasses under investigation demonstrate improved attenuation characteristics.

## Apply for student award at which level:

None

## Consent on use of personal information: Abstract Submission

Yes, I ACCEPT

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