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Study on Diagnostic X-ray Shielding Properties of Glass Doped with Lead

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Introduction: The radiation shielding efficiency of materials depends upon exposure technique, photon attenuation. X-ray has become indispensable part of diagnosisม which involve the risks occupation high radiation dose. This work focus on high quality radiation shielding materials for reduction of unnecessary radiation. Although the materials commonly used for radiation shielding is lead (Pb).

Purpose: In this work, study on is X-ray shielding properties of glass with doped lead oxide. The glass samples formula are (59.5-x) SiO2 : 20Na2O : 1.0Al2O3 : 13B2O3 : 6.3CaO : 0.2Sb2O3 : xPbO where x = 1.5, 3.0, 4.5, 6.0 and 7.5 mol%

Methods: The X-ray shielding efficiency was assessed using different categories of partial interaction parameters such as linear attenuation coefficient (μ) and half value layer (HVL), Mean free path (MFP), Ten Value layer (TVL). The X-ray shielding characterization was measured with a high frequency digital radiography Shimadzu model RAD Speed Pro X-ray machine operated at 50-100 kVp and 200 mA 0.25 s. The spectra were measurement and recorded by using Cd-Te X-ray Spectrometer. The optimum experimental distance set up between X-ray generators to glass samples and from glass samples to Cd-Te X-ray Spectrometer being at 50 cm separation distance.

Results: The result shows that lead oxide composition increase μ increase and HVL TVL and MFP decrease. The compared of glass samples at 7.5mol% in glass formula 52SiO2 : 20Na2O : 1.0Al2O3 : 13B2O3 : 6.3CaO : 0.2Sb2O3 : 7.5PbO with lead oxide, commercial window, brick, concrete, X-ray window found the HVL of glasses similar to x-ray window..

Conclusions: From the results, this glasses with doped lead oxide can replace X-ray window for reduce dose of lead used in production process in the future.

Keywords: Radiation shielding / Lead oxide / Glass

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Abbreviations:

μ: Linear attenuation coefficient
HVL: Half Value Layer
TVL: Tenth Value Layer
MFP: Mean Free Path

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