Bismuth modified gamma radiation shielding properties of titanium vanadium sodium tellurite glasses as a potent transparent radiation-resistant glass applications

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Abstract

This work reported the radiation shielding characteristic of the bismuth titanium vanadium sodium tellurite glass system. The density of the specially-developed glass samples was increased from 2.21 to 4.01 g/cm^3 with the addition of Bi_2O_3, despite the fact the molar volume is decease within 85.43–54.79 cm^3/mol. The WinXcom program was used to approximate the effect of Bi_2O_3 on the gamma radiation shielding parameters of bismuth titanium vanadium sodium tellurite glasses. The μ_m values decrease with the increase of Bi_2O_3 concentration. The computed data shows that the glass sample with 20 mol.% of Bi_2O_3 content has the greatest radiation attenuation performance in comparison to other selected glasses. The Bi_2O_3–TiO_2–V_2O_5–Na_2O–TeO_2 glass system shows excellent neutron shielding material with high long-term light transmittance and discharge resistance and could be potentially used as transparent radiation-resistant shielding glass applications.

***Keywords*:** Tellurite glasses; Mass attenuation coefficient; Effective removal cross-section; Radiation shielding

1. Introduction

Currently, there is a very drastic expansion in the use of radioisotopes in specific areas such as the construction of nuclear energy sources and radiotherapy plants. Therefore, it is necessary to increase the protective material that can be used as resistance to radiation in difficult conditions of nuclear radioactive exposure [1]. In the nuclear reactor, neutrons and gamma-ray are considered as the most significant types of radiation. Thus, it is important to study and