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РАДІАЦІЙНИЙ ЗАХИСТ, ПОТУЖНІСТЬ ДОЗИ ТА ГАЛЬМІВНА ЗДАТНІСТЬ СИСТЕМИ КАДМІЙ - ВІСМУТ - СВИНЕЦЬ - ЦИНК - БОРАТНЕ СКЛО: ВПЛИВ ЛЕГУВАННЯ Bi_2O_3

Скляні системи виду $(70\text{-}x)B_2O_3\text{-}10ZnO\text{-}10PbO\text{-}10CdO\text{-}xBi_2O_3$ (з x = 0 до 20 моль%) були виготовлені стандартним методом з розплаву та охарактеризовані. Досліджено роль варіювання вмісту легуючої речовини Bi_2O_3 на радіаційне ослаблення, потужність дози та гальмівну здатність запропонованих стекол. Було оцінено різні характеристики захисту від радіації, такі як коефіцієнти накопичення експозиції, константи гамма-випромінювання та потужності дози, а також загальний поперечний переріз ослаблення нейтронів. Рентгенівська дифрактометрія зразків показала їхні аморфні характеристики. Щільність скла була збільшена з 5,34 до 6,95 г/см^3, а ширина забороненої зони зменшувалася зі збільшенням вмісту легуючої речовини Bi_2O_3. Крім того, як величини ослаблення, так і ефективні атомні числа зразків (розраховані за допомогою програмного забезпечення Phy-X) в діапазоні енергій гамма-променів від 0,015 до 15 МеВ збільшувались зі збільшенням вмісту Bi_2O_3. Зі збільшенням легування Bi_2O_3 було збільшено ослаблення гамма-променів, гальмівна здатність і поперечний переріз ослаблення нейтронів. Отримана нова скляна композиція є хорошим кандидатом для захисту від радіації.

Ключові слова: захист від гамма-випромінювання, боратне скло, нейтронні перерізи, параметри ослаблення.

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RADIATION SHIELDING, DOSE RATE AND STOPPING POWER OF CADMIUM - BISMUTH - LEAD - ZINC - BORATE GLASS SYSTEM: INFLUENCE OF Bi_2O_3 DOPING

Glass systems of the form $(70\text{-}x)B_2O_3\text{-}10ZnO\text{-}10PbO\text{-}10CdO\text{-}xBi_2O_3$ (with x = 0 to 20 mol%) were prepared by the standard melt-quenching approach and characterized. The role of varying Bi_2O_3 doping contents on the radiation shielding, dose rate, and stopping power of the proposed glasses was examined. Various radiation shielding properties, such as exposure buildup factors, gamma-ray constants and dose rates, and total neutron removal cross-section, were estimated. The x-ray diffractometer patterns of the samples showed their amorphous characteristics. Glass density was increased from 5.34 to 6.95 g/cm^3, and the energy band gap was reduced with the increase in Bi_2O_3 doping contents. In addition, both mass attenuation numbers and effective atomic numbers of the samples (calculated using Phy-X software) in the gamma-ray energy range of 0.015 to 15 MeV were increased with the increase in Bi_2O_3 contents. With the increase in Bi_2O_3 doping, the gamma-ray shielding, stopping power, and neutron removal cross-section of the glasses were improved. This new glass composition was asserted to be a good candidate for radiation shielding applications.

Keywords: gamma-radiation shielding, borate glass, neutrons cross sections, attenuation parameters.

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