

Promising applicable heterometallic Al₂O₃/PbO₂ nanoparticles in shielding properties

ABSTRACT

Heterometal oxides of $(1 - x)\text{Al}_2\text{O}_3/x\text{PbO}_2$ (NPs) nanoparticles with different PbO₂ content ($x = 0, 0.3, 0.4, 0.5, 0.6$ and 0.7) have been prepared by irradiation method. The NPs powder has been checked by X-ray diffraction (XRD). XRD measurements affirmed the presence of both pure NPs and nanocomposites of $(1 - x)\text{Al}_2\text{O}_3/x\text{PbO}_2$ NPs with different PbO₂ contents. The calculated structural parameters which using the experimental result of XRD charts to give a complete image of these measurements. Moreover, the results using FLUKA code showed that the values attenuation coefficient (μ_m), high effective atomic number (Z_{eff}) and neutron shielding parameters increase as the lead dioxide increase in the Al₂O₃/PbO₂ samples. While the values of half-value layer (HVL) and mean free path (MFP) decrease with increasing PbO₂ content. The investigated shielding features of the chosen Al₂O₃/PbO₂ would be advantageous for exposure control.

Keyword: XRD; Al₂O₃; PbO₂; Heterometal oxides; FLUKA