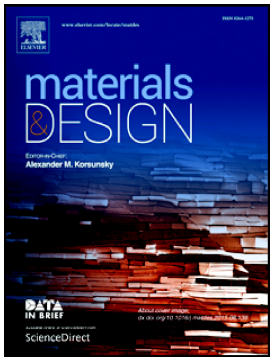

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Gamma ray shielding property, shielding mechanism and predicting model of continuous basalt fiber reinforced polymer matrix composite containing functional filler

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Abstract:

Functional shielding filler modified fiber reinforced polymer matrix composites are novel structural / radiation shielding materials with great potentials in applications such as nuclear industry and radioactive therapy. In this study, unidirectional basalt fiber reinforced epoxy resin matrix composite laminates containing different contents of tungsten (W) and erbium oxide (Er_2O_3) fillers were fabricated. Experimental measurement and theoretical calculation of mass attenuation coefficients of γ ray were carried out and analyzed based on photon shielding mechanism. The effects of filler content and photon energy of γ ray on shielding property of composite were studied. It is found that adding W and Er_2O_3 fillers significantly increases mass attenuation coefficient of basalt fiber composite, especially for low photon energy. The discrepancy between measured and calculated results is obvious at low filler content, and is believed to come from different considerations on penetrating photons, which have undergone slight Compton scattering. The corresponding mechanism was discussed. An empirical model based on photoelectric absorption effect, Compton scattering effect and effective atomic number is established to modify calculated mass attenuation coefficient. A good accuracy was validated, so the model can be used