FABRICATION OF COMPOSITE MATERIAL FOR RADIATION SHIELDING

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ABSTRACT

Composite materials are fabricated and characterized for utilization as shielding material against gamma radiation. In this report mechanical and shielding properties of Epoxy/Carbon fiber composites and Epoxy/Glass fiber composites with added lead nanoparticles were studied experimentally and computationally. The experimental part entailed the fabrication of epoxy/carbon fiber composites with lead nanoparticle additives using the hand layup vacuum bagging process. Mass attenuation coefficients were experimentally measured for different composites with different Pb-NP weight fractions using NaI (Tl) scintillation detector. It was found that adding small fractions of lead nanoparticles to the composite material led to an increase in their mass attenuation coefficients. The results also show that the mass attenuation coefficients of composite material with added Pb-NPs are higher than those of aluminum and lead. For the computational part of this study, an MCNP5 model was established for calculating the mass attenuation coefficients of epoxy/carbon fiber and epoxy/glass fiber composites with lead nanoparticle additives. The model was verified and validated for different materials and different particle additives. Results from the computational analysis show that the mass attenuation coefficient increases as the weight fraction of lead nanoparticles increases. Experimental results and computational results for composites with low weight fractions were in good agreement.