ABSTRACTS E-BOOK

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10. LEAD FREE POLYMER COMPOSITES FOR RADIATION SHIELDING

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Radiation shielding is a crucial precautionary measure in decreasing the dose of exposure medical personnel experience. The physical dimensions of these shields, specifically thickness and shape, are dependent on the type of radiation, energy and specific radioactivity. Currently, the most common radiation shielding equipment is made of lead, tungsten or uranium. Although these heavy metals have favorable shielding properties against ionizing radiation, protective garments such as lead aprons are heavy to wear and can pose significant health risks. Taking this into account, the primary goal of this study is to understand the radiation shielding properties of lead-free polymer geopolymer-polyurethane based composites. The geopolymer was synthesized using an 80%-20% mixture of fly ash and a bio-polyol substrate which was subsequently homogenized using MDI44. As a result, 6 samples of the geopolymer-polyurethane based composites were fabricated of which 5 were 90%-10% compositions between the mixture and varying concentrations of $BaSO_4$ and Bi_2O_3 respectively. The last sample consisted of the pure fly ash/bio-polyol mixture. XRF and ICP analysis was used to chemically characterize the fly ash. The composite structures were analyzed using XRD, while the microstructural morphology was investigated using SEM techniques. Utilizing an energy-dispersive x-ray spectrometer (EDS), elemental abundance and agglomerating behavior was analyzed for each composite variant. The X-ray attenuation measurements pointed out that the obtained composites have the potential for a design of lead-free protective clothing against X-ray shielding in medical applications.

Keywords: Radiation shielding, geopolymer, dosimetry