Utilization of a Polystyrene-Dense Metal Matrix to Reduce Radiation Exposure and Weight Characteristics

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Traditional methods for the reduction of exposure to radiation sources have relied on dense, heavy materials such as lead. While effective, these materials are less adaptable to situations that might benefit from less mass. Null Hypothesis - The polystyrene-heavy metal matrices will have no impact on the absorption of radiation compared to reduced volume. Alternate Hypothesis - The polystyrene-heavy metal matrix will decrease the weight of protective materials without compromising the effectiveness as a shield against radiation. The polystyrene foam was dissolved in acetone to return the structure to a polymer matrix. Lead was added in a variety of experimental concentrations to the polystyrene solution. The polystyrene matrix had a thickness of 10 millimeters. To test for the effectiveness of the matrix as a radiation shield, a meter was placed behind this mixture and the amount of radiation not diffused by the mixture was measured by a detector. This measurement was then recorded. With no shielding present, 203 counts were recorded over a thirty second interval. On a per gram basis, The solid lead blocks approximately 3.28 counts per gram. the 20g Pb blocked 16 counts per gram. The 30g Pb blocked 7.78 counts per gram. On a per gram basis, the polystyrene-20g Pb matrix blocked almost 5 times more radiation than the solid lead. The results of the experimental series would indicate that the addition of lead to a reprocessed polystyrene product would produce effective blockage of radiation, while at the same time reduce the weight required to achieve protection. This could be very useful for nuclear applications that require shielding but would benefit from less heavy products, such as the U.S. military and commercial energy generation facilities.