"HEA You, Stop That Radiation!" Polyimide-Taped High Entropy Alloys (HEAs) vs. Ionizing Radiation Shielding

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The purpose of this project was to design polyimide-taped high entropy alloys (HEAs) to shield ionizing radiation. It was hypothesized that if the thickness of each HEA is increased, then the counts of radiation that penetrate the HEA shield will decrease because more material causes less radiation to pass through due to radioactive waves/particles colliding with more material. Equimolar amounts of aluminum, tin, and copper were melted together with varying amounts of carbon nanotubes. The HEAs were then encased in polyimide tape and hammered down. The HEAs and the various shields were then exposed to alpha, beta, and gamma radiation so that the percent shielded could be calculated. Multiple one-way ANOVA tests at a significance level of 0.05 were conducted. The HEAs with beta and gamma radiation were significantly different ($p=0.000$) and ($p=0.013$) respectively. Additionally, a one-way ANOVA test was applied to show a significant difference between the material shields with alpha and beta particles ($p=0.007$) and ($p=0.000$) respectively. Additionally, increasing HEA thickness resulted in higher percentages of radiation shielding for all radiation types. The hypothesis was partially supported because the HEAs blocked a higher percentage of radiation when the thickness was increased, however, there were deviations in each HEA group. The results of this study would interest material scientists in space or nuclear agencies who are working to design materials that are resistant to radiation.

Awards Won: