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Bismuth-loaded Plastic Scintillator for Nuclear Security Applications

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In recent years a great deal of research has been devoted to the development of so-called spectroscopic plastic scintillator. The addition of high-Z materials increases the stopping power and photopeak efficiency of plastic scintillator albeit generally with a reduction in light yield. Common elements used for this development include tin (Z=50) and lead (Z=82), and such metal-loaded plastics are currently available commercially. Here we present characterisation of two new materials developed at Lawrence Livermore National Laboratory which make use of bismuth (Z=83) to enhance the effective atomic number of the scintillator.

Bi-PVT shows promise as a potential drop-in replacement for existing metal-loaded plastic systems. In particular, Bi-PVT is being investigated as a radiation portal monitor upgrade material, and we will present results of its implementation within a commercial dosimeter. Conversely, the novel material BLIP (Bismuth-Loaded Iridium Fluor Plastic) can achieve far higher loadings of metal before light reduction becomes detrimental to the performance of the scintillator. BLIP has been shown to surpass NaI(Tl) in the metric of counts per unit mass, suggesting deployment scenarios where weight becomes a major factor –aerial or backpack-mounted radiation detection equipment.

Authors: DALTON, George; LOUGHNEY, Kerri; Dr MORRIS, Luke; TAGGART, Matt (AWE Nuclear Security Technologies); LYONS-WAKE, Neal; WILLIAMS, Thomas

Presenter: TAGGART, Matt (AWE Nuclear Security Technologies)

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