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Evaluation of UO₂ for Solid-State Direct-Conversion Neutron Detection

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The objective of this work was to evaluate UO₂ as a solid-state direct-conversion neutron detector material by utilizing single crystal and thin films of UO₂. Initial investigations indicated the material properties were unsuitable and efforts were made to enhance grain size and increase electrical resistivity by using dopant materials. Samples of arc-fused single crystal UO₂ included that were doped by ion implanted were made into Schottky diode devices. Chemical solution deposition (CSD) utilized to produce higher resistivity UO₂ thin films. CeO₂ was also used as a nonradioactive simulant. ²⁵²Ca source irradiation was performed on UO₂ single crystal samples. A testing apparatus suitable for these samples was. Pulse height spectra data was collected and analyzed. MCNP and GEANT4 calculations were then made by a collaborator evaluating these samples. Co-doped samples of UO₂ were made to enhance this materials desirability in detection applications. Higher electrical resistivities and larger grain sizes are reported. CeO₂ samples are used as a non-radioactive simulant.

Authors: Mr SHAVER, Christopher (University of Tennessee); Mr MEEK, Thomas (University of Tennessee)

Presenter: Mr SHAVER, Christopher (University of Tennessee)

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