Thesis Topic:
Differentiating of Classes of Materials Using Neutron Interrogation Techniques

ABSTRACT

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Differentiating of classes of materials using neutron interrogation techniques.
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The great advantage of the neutron interrogation technique is that it allows the analysis of materials without the opening of storage containers. Because neutrons are very penetrating, they can enter into both metal and non-metal sealed containers easily. Likewise, the return gamma rays are also penetrating and can easily exit a metal or non-metal container to reveal the elemental contents of the sealed container.

The goal of this effort has been to develop, produce and test a scientific prototype of a small object scanner, capable of differentiating classes of materials using neutron interrogation techniques in which the material is excited to emit gamma radiation by neutron capture and scattering from the nuclei within the material under investigation. The scanner is based on High Purity Germanium technology (HPGe) because these detectors have the best available resolution. A deuterium-tritium neutron generator was used as a neutron source.

This report gives detailed procedures for detection algorithms and methods for the rapid neutron-based interrogation system. A mathematical model of the search time predicts well how long a search should be extended if lower thresholds are desired.