Sandia National Laboratories

Radiation Detection Materials

SAND2012-1148P

Potential Market Applications

- Public Safety
- Radiation Detection
- National Security

Benefits

- High sensitivity detection of fission neutrons with improved gamma ray rejection capability
- Simplified pulse processing and reduced timing requirements
- Elimination of hazardous material storage, transportation, and disposal
- Can be used to detect other components, such as oxygen
- Enhanced detection of special nuclear materials

Technology Readiness Level

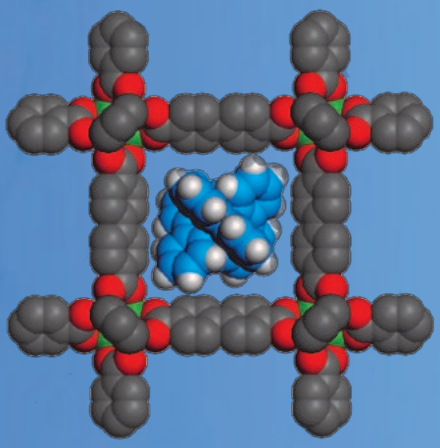
Sandia estimates this technology at approximately TRL 4. Key elements have been demonstrated in laboratory environments.

Intellectual Property

US Patent #7,985,868
SD# 10421.1
US Patent Pending on SD#11572

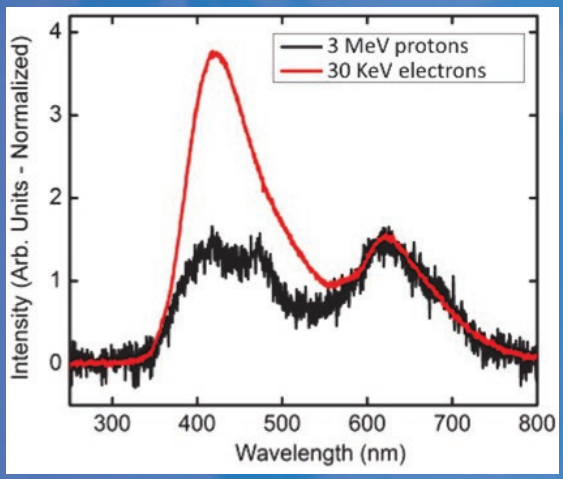
Technology Summary

Sandia National Laboratories has created a new class of scintillators with novel properties enabling use in a wide range of particle detection schemes, including pulse-shape discrimination methods for detecting fast neutrons. Known as Metal-Organic Frameworks (MOFs), they are crystalline nanoporous structures in which a luminescent organic component is chemically linked to a heavy metal ion such as zinc. The light output and timing of MOFs is highly tunable because their structure is governed by well-known chemistry, allowing the chemical nature of the organic fluor and its local environment to be tuned.



Biphenyl MOF infiltrated with Iridium triplet harvester

A wide variety of luminescent organic components can be incorporated. In addition, the nanopores in their structure can be infiltrated with species such as wavelength shifters, elements that facilitate detection of thermal neutrons, or additional hydrogen to increase the overall cross section for neutron detection. Infiltration with triplet exciton harvesters enables spectral shape discrimination (SSD), in which particle type is determined by the shape of the luminescence spectrum. MOFs therefore offer an unprecedented level of flexibility to design a scintillator for a specific radiation detection application. Because they are solids, the hazards associated with liquid organic scintillators are absent.



Spectral shape discrimination data for an iridium-MOF scintillator

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National Nuclear Security Administration

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