Composite Solid-State Scintillators for Neutron Detection

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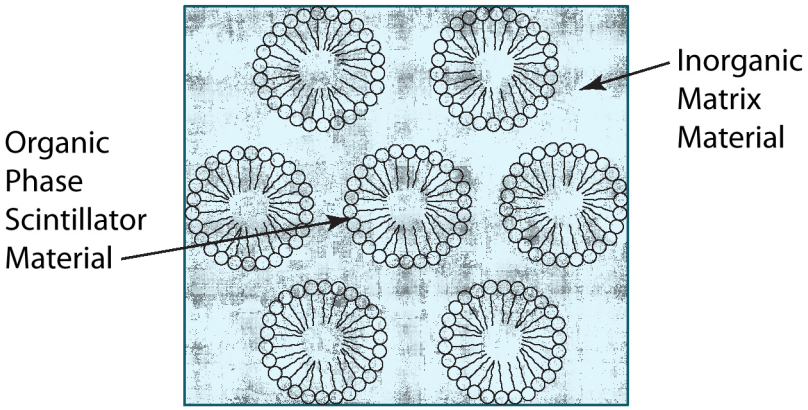

Technology Summary

Using a room temperature process, a new type of transparent, crack-free, monolithic scintillator has been developed at ORNL. This invention uses thin-film, glass, and fiber-optic sensors, and is based on the preparation of neutron scintillators with a room temperature sol-gel process. The result is an inexpensive, versatile system that is compatible with both inorganic and organic dopants for hybrid material processing.

Typically, solid-state neutron scintillators are prepared by high temperature methods, making them difficult to integrate as films into electronic devices for neutron detection. The conventional methods also eliminate the possibility of using organic scintillators because organic compounds are seldom stable at elevated temperatures. Other liquid scintillators have been developed; however, they are impractical due to handling constraints and leakage. As a result, there is a need for efficient in situ monitoring and imaging of radioactive contaminants.

This invention is a new type of solid-state scintillator for neutron detection consisting of an inorganic matrix homogeneously doped with a neutron absorbing material and an organic phase solubilized in a surfactant solution. The organic phase forms micelles, which are homogeneously doped into the transparent inorganic (silica gel) matrix.

Advantages

- Does not require rare materials
- Is easily integrated into electronic detection devices
- Greatly enhances fluorescence efficiencies
- Material is readily replicated to scale to large areas (such as square meters)

Potential Applications

- Manufacturing of neutron detectors with large areas for relatively high resolution neutron detection
- Monitor fissile material in situ through integration into electronic detecting devices
- Determine fissile matter within remote-handled transuranic waste
- Monitor spent nuclear fuel rods

Patent

Sheng Dai, Hee-Jung Im, and Michelle D. Pawel, *Composite Solid-State Scintillators for Neutron Detection,* U.S. Patent 7,105,832, issued September 12, 2006.

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