Sandia National Laboratories

SAND2012-1149P

Plastic Scintillators

Potential Market Applications

- Radiation Detection
- Public Safety
- National Security
- Nonproliferation

Benefits

- Fast neutron discrimination and gamma rejection
- Spectral (SSD) or Timing (PSD) -based particle discrimination
- Unprecedented control over scintillation pulse shapes and emission characteristics
- Improved luminosity over conventional organic scintillators
- Elimination of hazardous material storage, transportation, and disposal

Technology Readiness Level

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

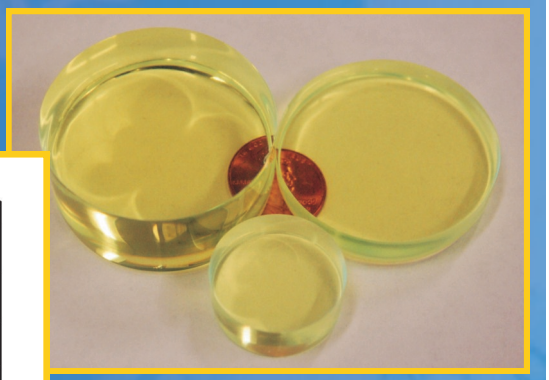
Intellectual Property

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

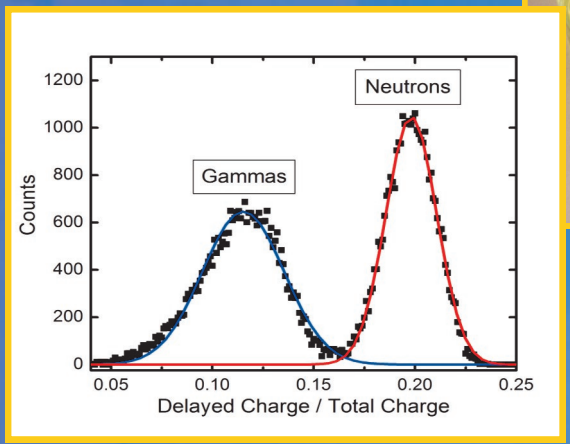
Technology Summary

Sandia National Laboratories has developed a class of plastic scintillators capable of fast neutron discrimination, enabling their use as a replacement for liquid scintillator neutron detector materials. The compositions comprise a conventional (low-cost) polymer base, doped with independently variable fluorescent and triplet-harvesting compounds. The incorporation of triplet-harvesting dopants in these materials leads to photophysical properties that are fundamentally different from those of existing organic scintillators. Associated advantages include improved luminosities, tunable pulse shapes, and superior scintillation timing characteristics. The latter is associated with truly exponential decay and a significant reduction in pulse pile-up relative to liquid scintillators.

The incorporation of distinct singlet and triplet luminescent states also permits simultaneous synthetic control over the scintillation timing response and wavelength characteristics, which allows for particle discrimination according to spectral-shape discrimination (SSD) and pulse-shape discrimination (PSD). In SSD, optically-resolved particle discrimination is performed by comparison of the spectrally-separated singlet and triplet scintillation components. *Alternatively, particle discrimination may be performed according to conventional PSD methods, which allows for simple replacement of existing liquid scintillator cells with minimal hardware reconfiguration.*



PSD-Capable Doped Plastic Scintillators



Neutron/Gamma Pulse-Shape Discrimination in a Doped Plastic Scintillator

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National Nuclear Security Administration

Sandia National Laboratories

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