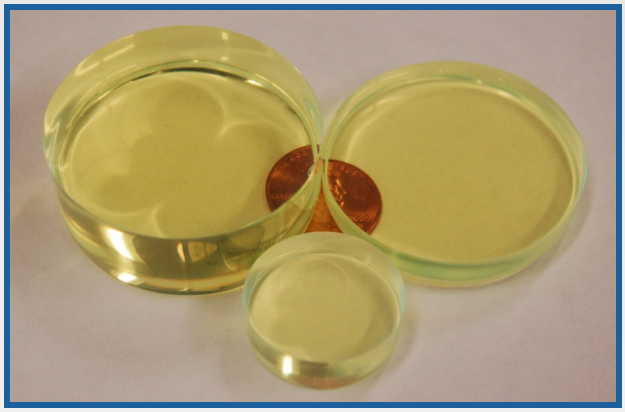
NEW CLASS OF PLASTIC SCINTILLATORS

TECHNOLOGY SUMMARY

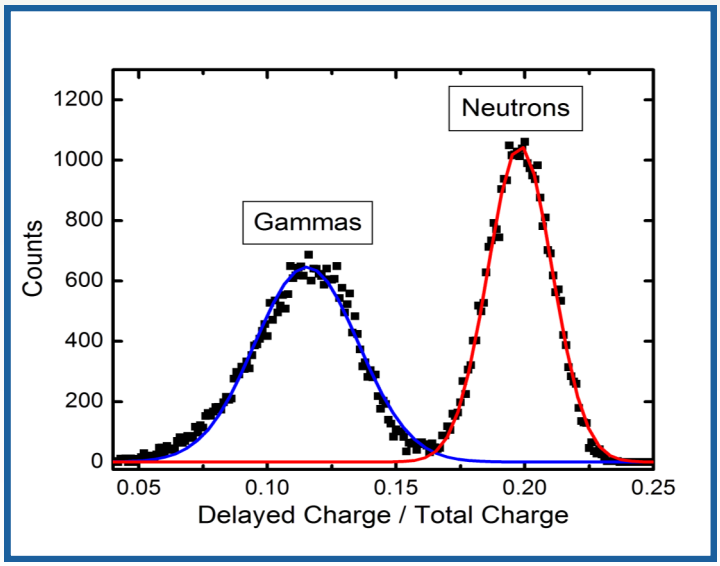
US PATENT PENDING

Sandia National Laboratories has developed a class of plastic scintillators capable of detecting fission neutrons, while discriminating against interfering gamma rays, enabling their use as a replacement for liquid scintillator neutron detector materials. Currently, pulse shape discrimination (PSD) is the most effective way of gamma rejection in liquid organic scintillators, however low luminosity for neutron scatter events and restricted volume required for nanosecond timing, limit the sensitivity of PSD scintillators.



PSD-Capable Doped Plastic Scintillators

The composition consists of a low cost polymer base, doped with an independently variable fluorescent and triplet-harvesting compounds. The incorporation of triplet-harvesting dopants into the material creates physical properties that are fundamentally different from those of existing organic scintillators. Advantages of these new properties include improved luminosities, tunable pulse shapes, and superior scintillation timing characteristics. It also reduces the radiative lifetime of triplet excited states through spin orbit coupling, enables sub-microsecond radiative decay, and eliminates the need for hazardous liquid scintillators.



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

Another advantage of these new properties is that they allow for synthetic control over the scintillation timing response and wavelength characteristics, which allows for particle discrimination by (SSD) spectral shape discrimination and (PSD) pulse shape discrimination. Particle discrimination may also be performed with conventional PSD methods, which allows for simple replacement of existing liquid scintillator cells with minimal hardware reconfiguration.

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SAND # 2012-5881

POTENTIAL APPLICATIONS

- Radiation Detection
- Public Safety
- National Security
- Nonproliferation

TECHNOLOGICAL 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 to have a technology readiness level of approximately 4. Key elements of this technology have been demonstrated in laboratory environments.

CONTACT INFORMATION

For more information or to discuss licensing opportunities contact us at ip@sandia.gov.

Refer to SD # 11572

Or to learn more, please visit our website at https://ip.sandia.gov.

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