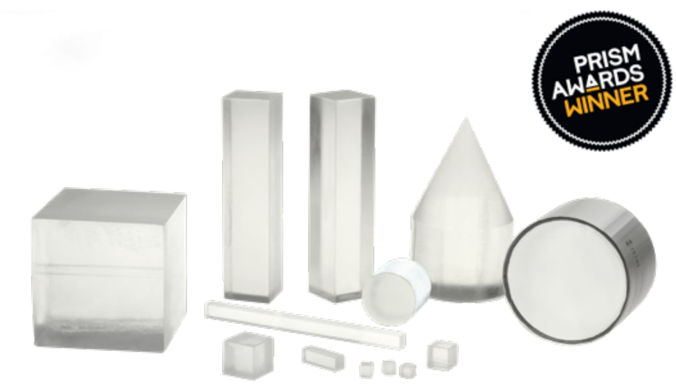
Inradoptics

Chemical Formula:	$C_{14}H_{12}$
Crystal Symmetry:	**monoclinic**
Optical Symmetry:	**biaxial**
Class:	$P2_1/c$

Scintinel™

Stilbene Single Crystals



OVERVIEW

Crystalline stilbene is an organic scintillator used for radiation detection and is well-suited for discrimination between fast neutrons and a gamma-ray background. A fast neutron is one with kinetic energy above approximately 1 MeV. Fast neutron counting, spectroscopy, and imaging have applications in medicine, industry, research, defense, and homeland security.

Inrad Optics Scintinel™ is produced using a proprietary low temperature solution growth technology. This method yields high-quality, low-stress material. All stilbene crystal growth, fabrication, and polishing is performed at our New Jersey facility, ensuring complete traceability and satisfaction with every Scintinel™ crystal shipped.

Features	Advantages of SCINTINEL™
Direct detection of fast neutrons	• Neutrons do not need to be moderated to lower energies • Measurements can take advantage of the low background, long attenuation length, and minimal number of benign sources of fast neutrons.
Excellent discrimination between neutrons and gamma rays	• Eliminates false positives from gamma radiation • Permits use of lower energy thresholds
Solid, light-weight, non-hygroscopic, not flammable, not hazardous	• Unpackaged stilbene is stable • Avoids the transportation, storage, and handling concerns associated with many liquid organic scintillators.

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SHAPES, SIZES AND PACKAGING

Inrad Optics can fabricate stilbene into a variety of geometries from 3 mm up to 130 mm [5"] including cylinders, disks, cubes, cones, frustrums, and plates. Typically, Scintinel™ single crystals are provided with edges beveled, one face commercially polished and protected by a fused silica optical window, and all other surfaces fine ground.

Right cylinders of dimensions Ø1"x1", Ø2"x2", are available as a standard product and can be provided stand-alone, wrapped in PTFE tape, or packaged in 1" and 2" canisters for easy optical coupling to photomultiplier tubes.

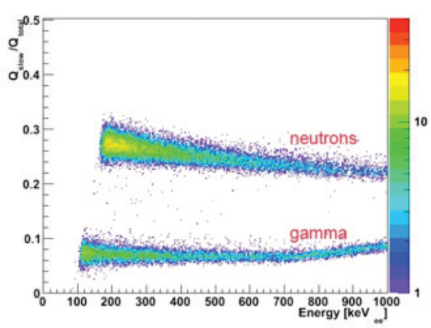
HANDLING STILBENE

Stilbene can be handled in a similar manner as other crystalline materials. Allow stilbene to equilibrate to room temperature. Small stilbene parts can be safely heated and cooled at rates of 1°C/minute. Silicone grease may be used to achieve an optical contact. Clean stilbene by gently wiping with a soft, dry cloth. Do not use solvents as these will attack the surface. For more information, download "Handling Instructions for Stilbene Crystal Products" at www.inradoptics.com.

Scintillation Peak	390 nm
Melting Point	124 °C
Refractive Indices (at 589 nm)	1.703, 1.724, 1.844
Density	1.15 g/cm^3

PULSE SHAPE DISCRIMINATION

The scintillation light pulse emitted from stilbene consists of both a prompt and a delayed fluorescence. The fraction of light resulting from the slow component often depends on the type of particle interacting with the crystal. Pulse shape discrimination (PSD) methods exploit this effect to separate events arising from neutrons and gamma rays. The pulse shape discrimination pattern of Scintinel™ shows exceptional neutron-gamma separation, with a figure of merit of 4.7 measured near 500 keVee. The figure of merit is calculated as the separation between gamma ray and neutron peaks divided by the sum of the full-widths at half maximum of the relevant peaks. The energy scale was calibrated using the Compton edge of ^{137}Cs and is presented in units of keVee (keV electron equivalent) to account for the particle-dependent variation in light output per keV deposited in the scintillator.



Pulse shape discrimination data from Inrad Optics stilbene (^{252}Cf source). Data courtesy of N. Zaitseva, LLNL.

Details regarding experimental methods for pulse shape discrimination with stilbene can be found in: Zaitseva, N. et al., IEEE Trans. Nucl. Sci., vol. 58, no.6, pp.3411-3420, 2011.

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