BORON LOADED PLASTIC SCINTILLATOR
EJ-254

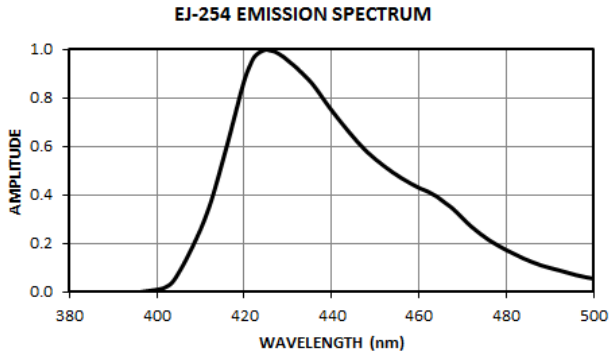
This blue-emitting plastic scintillator contains natural boron at concentrations up to 5% by weight. It is a clear, stable plastic with physical properties similar to those of the standard Eljen plastic scintillators. Its principal applications are fast neutron spectrometry and thermal neutron detection. The primary function of the boron is to provide a unique scintillation signal for low energy neutrons. The standard formulation contains 5% boron, and practical boron concentrations down to 1% are available.

The isotopic fraction of ^{10}B in natural boron is 19.9%, meaning that the 5% loaded plastic contains nearly 1% of ^{10}B. The neutron capture reaction on the boron $^{10}B(n,\alpha\gamma)^{7}Li$ has a Q value of 2.78 MeV of which 2.34 MeV is shared by the alpha and lithium particles. This energy is fully captured in the plastic to produce a scintillation signal approximately equivalent in amplitude to that of a 76 keV electron. For delayed coincidence timing of the capture of fast neutrons, the time delay from the prompt recoil-proton pulse is typically 2.7 µs for 5% B-nat plastics. This delay is inversely proportional to the boron loading.

Reference: D. M. Drake et al., Nucl. Instr. & Meth., A247, 576-582 (1986)

PROPERTIES	EJ-254 (% boron)		
	5%	2.5%	1%
Light Output (% Anthracene)	48	56	60
Scintillation Efficiency (photons/1 MeV e^-)	7,500	8,600	9,200
Wavelength of Maximum Emission (nm)	425	425	425
Rise Time (ns)	0.85	0.85	0.85
Decay Time (ns)	1.51	1.51	1.51
Pulse Width, FWHM (ns)	2.24	2.24	2.24
H Atoms per cm³ ($\times 10^{22}$)	5.18	5.17	5.16
C Atoms per cm³ ($\times 10^{22}$)	4.44	4.55	4.62
^{10}B Atoms per cm³ ($\times 10^{20}$)	5.68	2.83	1.14
Electrons per cm³ ($\times 10^{23}$)	3.33	3.33	3.33
Density (g/cm^3)	1.026	1.023	1.021

Polymer Base	Polyvinyltoluene
Refractive Index	1.58
Softening Point	75°C
Vapor Pressure	Vacuum-compatible
Coefficient of Linear Expansion	7.8×10^{-5} below 67°C
Temperature Range	-60°C to 60°C
Light Output (L.O.) vs. Temperature	At 60°C, L.O. = 95% of that at 20°C No change from -60°C to 20°C



CHEMICAL COMPATIBILITY

Attacked By: Aromatic solvents, Chlorinated solvents, Ketones, Solvent bonding cements, etc.
Stable In: Water, Dilute acids and alkalis, Lower alcohols, Silicone greases.
It is safe to use most epoxies with this scintillator.

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