EJ-301 LIQUID SCINTILLATOR

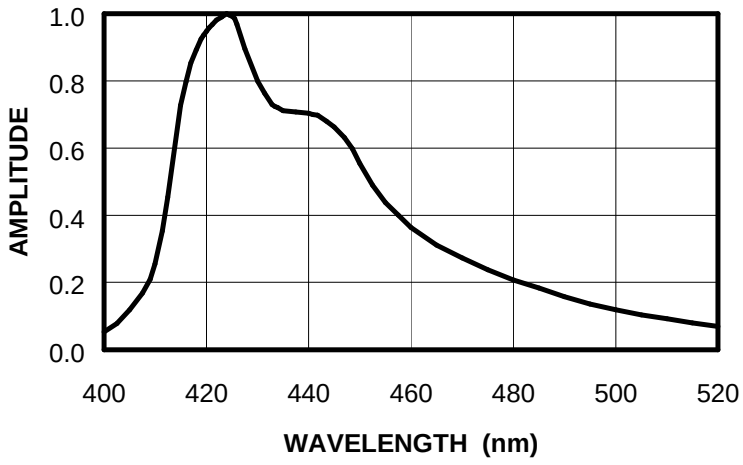
This scintillator exhibits excellent pulse shape discrimination (PSD) properties, particularly for fast neutron counting and spectrometry in the presence of gamma radiation. It is identical to the widely reported NE-213 and, therefore, exhibits all of the properties of that scintillator.

EJ-301 can be supplied ready for immediate use encapsulated at the factory in sealed aluminum or glass cells of a variety of types made to the customer's required dimensions. It is also supplied in bottles or drums sealed under inert gas. However, after being transferred to a cell or tank it should be deoxygenated again by sparging with pure nitrogen or argon for a duration proportional to the cell size immediately before sealing in order to achieve excellent PSD performance.

PROPERTIES

Light Output (% Anthracene)	78%
No. of Blue Photons per 1 MeV of Electron Energy	12,000
Wavelength of Maximum Emission	425 nm
Specific Gravity	0.874
Atomic Ratio, H:C	1.212
No. of C Atoms per cm^3	3.98×10^{22}
No. of H Atoms per cm^3	4.82×10^{22}
No. of Electrons per cm^3	2.27×10^{23}
Flash Point (T.O.C.)	26^oC (79^oF)
Boiling Point at one atmosphere	141^OC (285^OF)
Refractive Index, n_D	1.505
Decay Time (short component)	3.2 ns
Bulk Light Attenuation Length	2.5-3 meters
Mean Decay Times of First 3 Components (ref. 1)	3.16, 32.3 & 270 ns
No. of Photoelectrons per kev energy loss using an RCA-8575 PMT (ref. 1)	1.7
Alpha/Beta Ratio, "fast" (ref. 2)	0.073
Alpha/Beta Ratio, "slow" (ref. 2)	0.098

EJ-301 EMISSION SPECTRUM



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Pulse Shape Discrimination

PSD figure of merit, M, is defined as the separation between the neutron and gamma peaks divided by the sum of the FWHM of the neutron and gamma peaks at 1 MeV electron energy. Measurements of 3.5 [ref. 3, Fig. 1] and 3.9 [ref. 4, Fig. 6] have been reported. PSD figure of merit, D, defined as the separation between the neutron and gamma peaks divided by the variance in the PSD signals at 1 MeV electron energy is 11.3 [ref. 3, Fig. 1].

For values of M and D at other energies and for electron rejection ratios, see Figs. 3a, 3b & 4 of ref. 3 and Fig. 6 of ref. 4.

Response to Protons:

$E = 0.83P – 2.82 (1- \exp(-0.25P^{0.93})$ where P is the proton energy in MeV and E is the electron energy in MeV that gives the same light output in the range 1-300 MeV. [ref. 5] A more precise study in the energy range 5-17 MeV developed the following relationship [ref.6].
$E_e(MeV) = -1.092 + 0.5517E_p + 0.00461E_p^2$

Neutron and Gamma Spectrometry

The absolute differential efficiency and neutron spectra for a nominally 5 cm dia. x 5 cm cell for energies between 0.2 and 22 MeV are presented in reference 7. Gamma spectra analysis at energies above 3 MeV taken with three different sized scintillators is presented in ref.8. Methods of analyzing neutron and gamma spectra are compared in ref. 9.

References

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