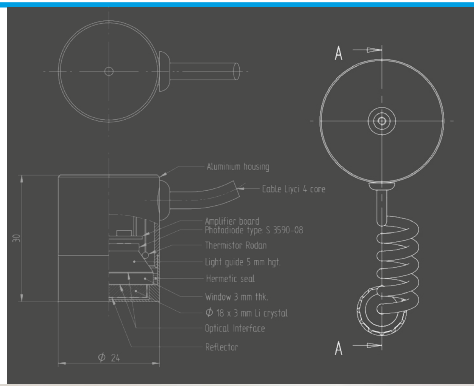
Cerium Bromide Detectors



$CeBr_3$

Radiation Detectors

Introducing $CeBr_3$

Cerium Bromide is the latest development in room temperature, high resolution scintillation detectors and with a low intrinsic background, is a superior alternative to Lanthanum Halide based scinitillators for applications including: homeland security, high resolution gamma spectrometry, medical imaging and geological exploration.

$CeBr_3$ has high light output, fast response, and shows very high energy and timing resolution. The detector's features include:

- Room temperature operation
- Same form factor as NaI(Tl) detectors
- Directly compatible with traditional scintillation detector electronics & multi-channel analysers
- Supplied in sealed metal housing

Above an energy of 200 keV the resolution is superior to NaI(Tl). It also shows good proportionality of response over the gamma energy range from 122 to 1274 keV*[1] and as cerium is an activator for the luminescence process, the crystal does not need any additional doping to aid scintillation, unlike Lanthanum Halides.

Furthermore $CeBr_3$ scintillation detectors do not suffer from the intrinsic background (self-activity) typical for Lanthanum Halide detectors like $LaCl_3$:Ce and $LaBr_3$:Ce.

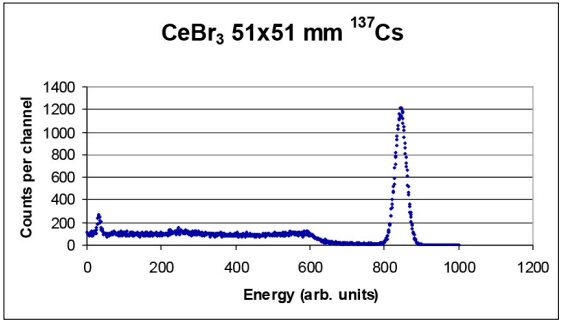
In $LaBr_3$ for example, self-activity is primarily due to ^{138}La that emits conversion electrons and β-particles with energy of up to 1.7 MeV. The self-activity due to ^{138}La in LaBr3 has an intrinsic count-rate of ~1.5 events/(cm^3/sec). However, the self-activity of $CeBr_3$ (due to ^{142}Ce that emits β-particles with total energy of 4.5 MeV) is $4x10^{-4}$ events/(cm^3/sec). Thus, the self-activity of $CeBr_3$ is about 3750 times lower than that in $LaBr_3$.*[2]

While self-activity issues are not critical in PET (which relies on coincidence measurements), the negligible self-activity of $CeBr_3$ makes it more attractive in large radionuclide detection and imaging systems required for homeland security applications. In these systems, large detector volumes are required and the expected extrinsic count-rate can be extremely low which requires detectors with very low background.

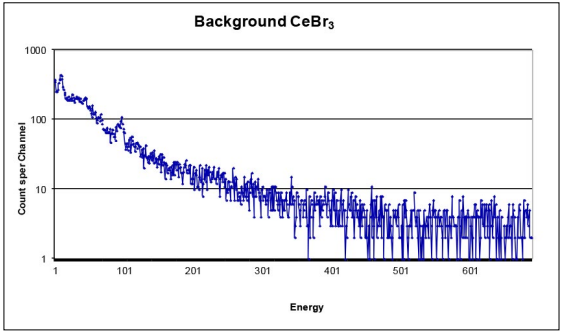
$CeBr_3$ is well suited for applications requiring fast response, high count-rates, and good timing resolution. $CeBr_3$ scintillators can also be expected to provide accurate time-of-flight (TOF) information.

Uses

- Homeland Security
- Medical Imaging (PET)
- Gamma Spectrometry
- Single Photon Emission Computed Tomography (SPECT)
- Nuclear & Particle Physics Research
- X-Ray Diffraction (Very fast scintillation material)
- NDT - Non Destructive Testing
- Decommissioning & Environmental Monitoring
- Geological & Oil Exploration
- NORM Detection
- Food Contamination Monitoring



4% Resolution at 662 keV

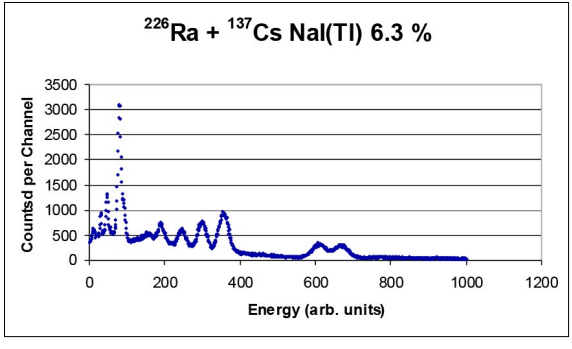


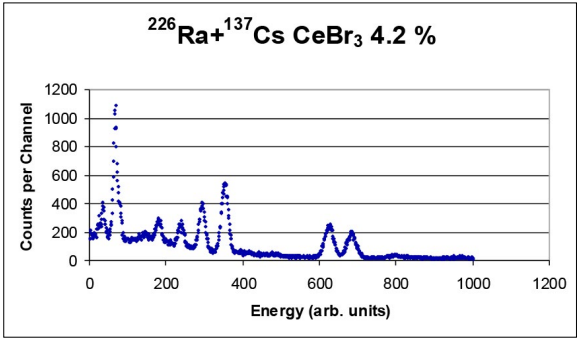
Low Intrinsic background

Properties

Density: 5.2 g / cc
Emission Wavelength: 380 nm
Decay Time: 17ns
Radiological Background: Negligible
Hygroscopic: Yes

The Difference between NaI(tl) and $CeBr_3$





	NaI(Tl)	$CeBr_3$
Relative photoelectron yield	100	125
Energy (kEV)	Typical energy resolution (FWHM) %	
30	18	22
60	12	15
81	11	13.5
122	9	11
356	8	5
662	6.5	4
1332	4.9	3
2600	4.0	2

References for this document:

*[1]P.Schotanus - Scionix,

*[2]K.S.Shah - New Scintillation Detectors for PET - 2010