excelitas® | LUXIUM™

Luxium™ Lanthanum Bromide and Luxium™ Enhanced Lanthanum Bromide

Luxium™ Lanthanum Bromide [$LaBr_3(Ce)$][1] has been the reference for excellent energy resolution combined with fast emission and good linearity.

We now offer a new **Luxium™ Enhanced Lanthanum Bromide** [$LaBr_3(Ce+Sr)$], which raises the bar for energy resolution.

Lanthanum Bromide provides an excellent energy resolution for a scintillator. FWHM (full width at half maximum) is below 3.0% at 662keV on large production : the average values for the premium designs are available today at 2.6% at 662keV.

The linearity output is excellent, and the fast emission allows high count rate capabilities. Moreover, the light yield as a function of the temperature is unique if we consider the nominal light output which is significantly higher compared to NaI(Tl) (165%).

With all these characteristics, **Lanthanum Bromide** scintillation material is already an excellent choice for a wide range of spectroscopy or timing applications.

Best energy resolution | Fast emission
Excellent linearity | High count rate capabilities
Excellent light output stability with T°

FWHM of
Enhanced Lanthanum Bromide
has been measured at 2.2% at 662keV

Enhanced Lanthanum Bromide material maintains most of the excellent properties of the standard **Lanthanum Bromide** and improves the energy resolution. It is now your choice when the best in class energy resolution is needed.

Enhanced Lanthanum Bromide is available in the same sizes and designs as standard **Lanthanum Bromide**. As an extension of the standard **Lanthanum Bromide**, it opens new perspectives for applications such as High Energy Physics Experiment, Prompt Gamma Neutron Activation Analysis (PGNAA) and others.

The ultimate Scintillator energy resolution
Available in a wide range of size

Properties

	Luxium™ Standard $LaBr_3(Ce)$	Luxium™ Enhanced $LaBr_3(Ce+Sr)$
Energy Resolution @ 662KeV	**2.6%**	**2.2%**
Photoelectron yield [% of NaI(Tl)] (for γ-rays)	**165**	**>190**
Wavelength of emission max [nm]	380	385
Primary decay time [µs]	0.016	0.025
Light yield [photons/keVγ]	63	73
Refractive index @ emission max.	~1.9	~2.0
Density [g/cm³]	5.08	
Hygroscopic	yes	

Luxium™ Lanthanum Bromide and Luxium™ Enhanced Lanthanum Bromide Scintillation Materials

The spectroscopic properties and the premium energy resolution for **Enhanced Lanthanum Bromide** are fundamentally based on the improved proportionality of scintillation material [1]. The scintillator shows good efficiency up to practical interesting temperatures (~175°C).

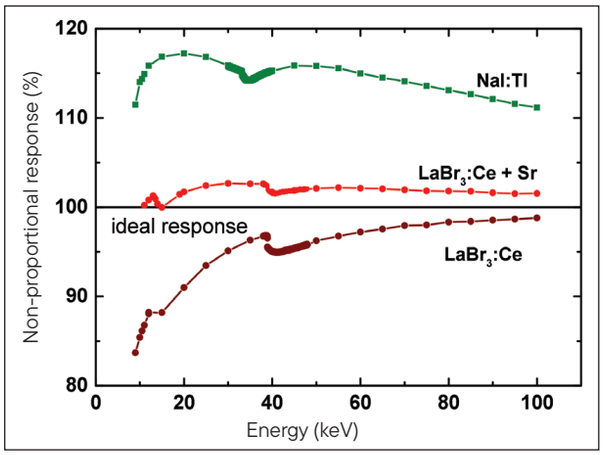


Figure 1. Non-proportionality of Lanthanum Bromide & Enhanced Lanthanum Bromide compared to NaI(Tl)

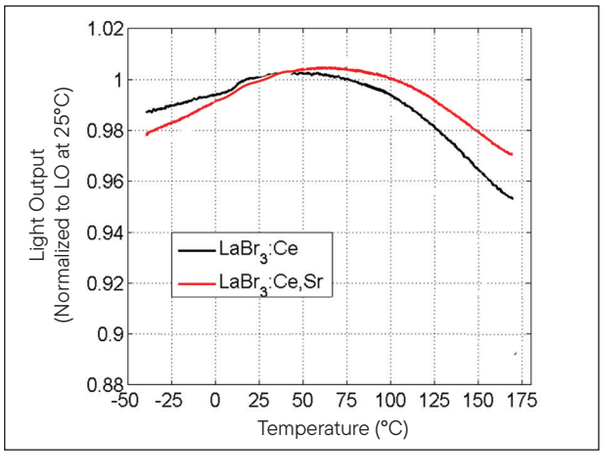


Figure 2. Light yield as a function of the temperature

The co-doped **Enhanced Lanthanum Bromide** scintillator provides a new feature: the difference in decay time for gamma and alpha-particles interactions that is not observed in the standard $LaBr_3$ scintillator. That creates a valuable option to eliminate the contribution of natural intrinsic background activity through digital pulse-shaped discrimination technique [2].

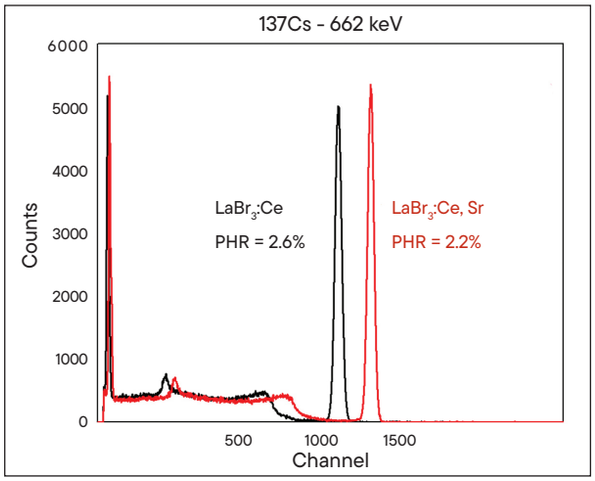


Figure 3. Pulse height spectrum compared between Lanthanum Bromide & Enhanced Lanthanum Bromide

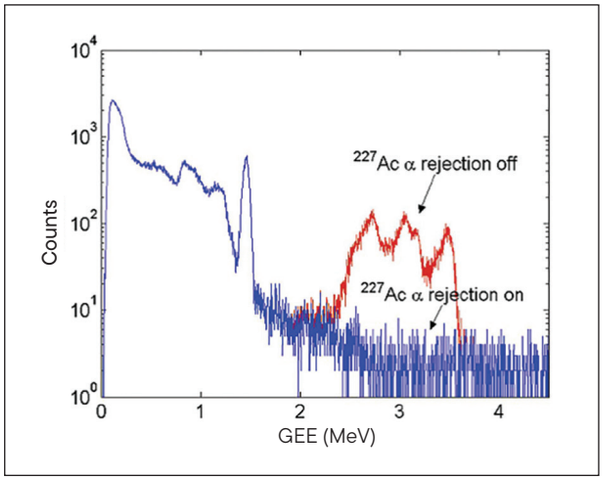


Figure 4. Radiation background spectrum of LaBr3:Ce, Sr with and without α rejection.

REFERENCES:

[1] M.S. Alekhin, J.T.M. de Haas, I.V. Khodyuk, K.W. Kramer, P.R. Menge, V. Ouspenski, P. Dorenbos "Improvement of γ-ray energy resolution of $LaBr_3:Ce^{3+}$ scintillation detectors by Sr^{2+} and Ca^{2+} co-doping", APL 102, 161915 (2013)

[2] Kan Yang, Peter R. Menge, Vladimir Ouspenski "Enhanced α–γ Discrimination in Co-doped $LaBr_3:Ce$", IEEE Vol. 63, No. 1. (2016)

[1] E. V. D. van Loef, P. Dorenbos , C. W. E. van Eijk, H.U. Gudel, K.W. Kraemer; *Applied Physics Letters*, 79, pp 1573-1575 (2001).

[2] Refer to Luxium Solutions Technical Note " BrilLanCe Scintillators: Performance Summary."

Protected under patents US7067816B2,US7250609B2,EP1257612B1,EP1516078B1,ZL03813659.7,UA75066C2*

**This original patent was granted to Stichting Voor de Technische Wetenschappen.*

Inventors are P. Dorenbos, C. W. E. van Eijk, H.U. Gudel, K.W. Kraemer, E. V. D. van Loef.

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