LBR/LaBr SCINTILLATION CRYSTAL BLANK SPECIFICATIONS

LaBr, Lanthanum Bromide, when activated with small molar percentage of Cerium is an efficient High Z, Fast scintillator. The crystal is hygroscopic and to ensure machinability and better scintillation performance, certain anions and/or cat ions are added in various percentages to enhance the overall properties of this scintillation mixed-crystal phosphor. An optimum concentration of this proprietary addition is ≤ 5% . Hence, the acronym "**LBR/LaBr**"

Physio-Chemical Properties

Chemical Name:	Lanthanum Bromide
Chemical Formula:	La(x)Br(x)
Density (g/cm^3)	5.06
Effective Atomic No. Z_{eff}	50
Type	Single Crystal
Structure	$P6_3/m$, No. 176
Optical Quality	Clear
Index of Refraction	1.82
Mechanical Behavior at Room Temp.	Brittle
Cleavage	None
Hardness (Mho)	5.8
Rugged	Yes
Hygroscopic	Yes
Melting Point (^{0}C)	783

Radiation-Scintillation Properties

Relative light yield, PH (%)-PMT	> 1.7 (compared to NaI(Tl))
Photon Yield/Mev (PMT Sensor)	63,000
ΔE/E-% FWHM for **Dia. = Ø60" x 10mm L**	**2.7% BEST MEASURED**
Emission Peak Wavelength (nm)	380
Decay Constant At Room Temp. (ns)	16-26 Depending on Ce Content
Afterglow at 3 msec (%)	
Rise Times-ns (10%-90%)	
Radiation Length (cm)	2.13
Radiation Hardness To γ Ray (rad)	>10^6

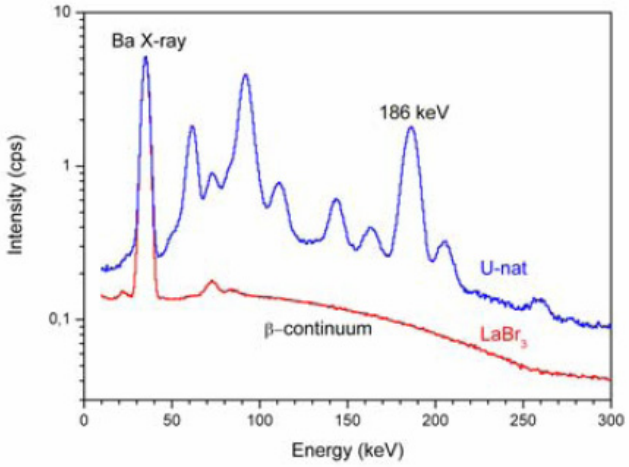
Background

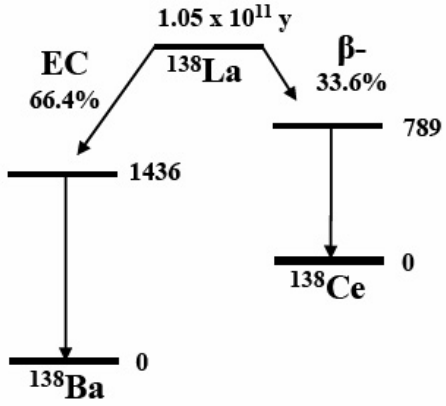
[A peculiarity of the lanthanum-based scintillators is the presence of an inherent background originating from the electron capture and β-decay of the long-lived minor La isotope ^{138}La ($t^{1/2} = 1.05 \times 10^{11}$y) to ^{138}Ba (66.4%) and ^{138}Ce (33.6%, see schematic decay scheme in Fig. 1). The Ba X-ray peak visible in the $LaBr_3$ spectra in Figs. 2 and 3 results from the EC decay of ^{138}La to ^{138}Ba (the single X-ray peak near 37.4 kev in fact represents the accumulated energy given off by the X-rays in the EC process). The β-decay to ^{138}Ce, in turn, manifests itself in a beta continuum background with an end-point energy of 255 kev.

REXON COMPONENTS, INC.
24500 Highpoint Road
Beachwood, Ohio 44122-6022 USA

E-mail: sales@rexon.com
Visit us at www.rexon.com

Phone: (216) 292-7373
Fax: (216) 292-7714
Phone (24/7): 440) 585-7086





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Uranium Enrichment Assay with a LaBr3(Ce) Scintillation Detector: A Promising Option for the 2nd Generation of COMPUCEA

H. Ottmar, P. Amador, H. Eberle, N. Erdmann, H. Schorlé
European Commission, Joint Research Centre
Institute for Transuranium Elements, P.O. Box 2340
D-76125 Karlsruhe, Germany

R. Gunnink
Consultant, 7913 Jonathan Woods Dr., Ada, MI 49301, USA]

LBR/$LaBr_3$ CRYSTAL BLANK SPECIFICATIONS

Dimensions: **Length**_____ **Width**_____**Height**_____

OR

Diameter_____ **Length**_____

OR **For Other Geometries Attach a Drawing or Sketch**

Tolerances: All dimensions +.25/-.00mm (+.010"/-.000")

Resolution: For **Dia.** = **Ø10mm x 10mm Length ≤** to 3% FWHM @ 662Kev for Cs137*

Appearance: Crystal blanks are to be water white with NO visual imperfections. Such imperfections typically include flock & inclusions, striae, edge cracks due to heat fractures, etc. - The crystal blank should be free from these defects.

*As measured with a catalog spec. Hamamatsu R-1306 2" PMT or equivalent

It is not necessary to measure each and every blank. A representative sample cut from the same boule or ingot-section should meet this performance criteria.

All surfaces supplied are at minimum industry-standard scintillation polish, unless otherwise specified.