

Lithium Glass Scintillators

Glass Types

The glass scintillators are divided into 3 principal types, based on the percentage weight of lithium content (Table 1). Each of these is available in natural, ⁶Li enriched or ⁶Li depleted form.

Table 1

Lithium oxide content by weight	Natural	⁶ Li Enriched (95% ⁶ Li)	⁶ Li Depleted (99.9% ⁷ Li)
6%	GS1	GS2	GS3
18%	GS10	GS20	GS30
21%	KG1	KG2	KG3

(The lithium contents quoted are the initial values of the constituents of the melt.)

Glass Forms

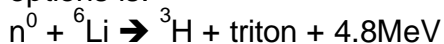
In addition to fibres, the glass can be supplied as cylinders, rods, discs or plates. Shapes can be provided to customer specification including drilling and polishing and coating with highly reflective paint. Large scintillators (>400g) can be produced as arrays of performance mapped pieces.

Material background

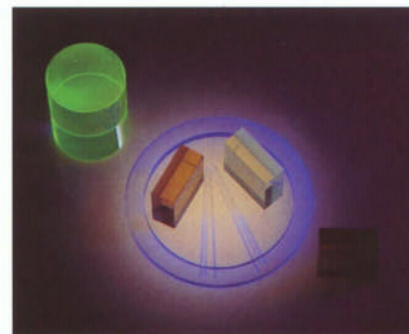
With an operating range from -200°C to 250°C coupled with being resistant to nearly all organic and inorganic chemicals (except hydrofluoric acid), AST's cerium activated lithium glass scintillators can be used in conditions which prohibit the use of other scintillation materials.



The neutron detection mechanism in ⁶Li enriched options is:



AST's ⁶Li glass thermal neutron scintillators can be selected to provide the neutron and gamma performance characteristics for individual applications.



Physical Properties

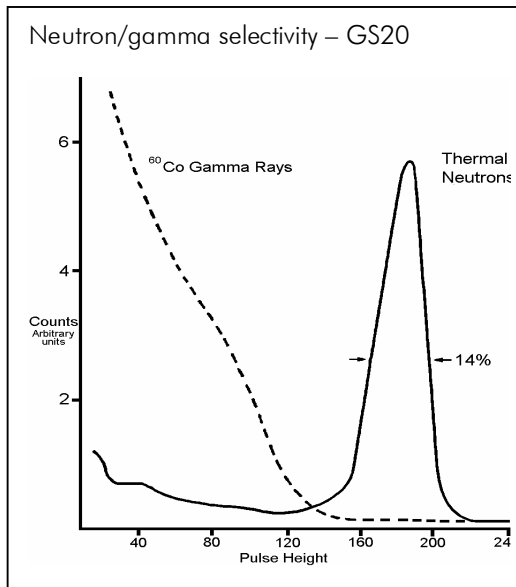
	GS1/2/3	GS10/20/30	KG1/2/3
Density (g/ml)	2.66	2.50	2.42
Refractive Index n ₄₀₄₇	1.58	1.55	1.566
Glass Transition T _g (°C)	620	499	464
Softening Point T _s (°C)	650	522	490
Strain Point T _{sr} (°C)	350	410	461
Coefficient of linear expansion	7 x 10 ⁻⁶	9.23 x 10 ⁻⁶	100 x 10 ⁻⁶
Wavelength of maximum emission (nm)	395	395	395
Relative light pulse height per unit energy input	100(1)	85	60
Light output relative to anthracene	22-34%(2)	20-30%(2)	20%
Decay time (ns)	50 - 70	50 - 70	50 - 70
Resolution on the thermal neutron peak obtained with moderated Po/Be neutrons (depending on geometry of whole system)	13 - 22% (GS2)	15 - 28% (GS20)	20 - 30% (KG2)
Peak/trough ratio of above peak (range) for thermal neutrons	15:1 to 40:1 (GS2)	10:1 to 40:1 (GS20)	10:1 to 20:1 (KG2)

(1) Pulse height of GS1 is 15% that of Sodium Iodide.

(2) Determined by thickness, increasing with decreasing thickness down to approximately 2 mm.

Selectivity

^6Li glass has low gamma sensitivity allowing good signal discrimination between neutron and gamma interactions – a high gamma signal being common in neutron sources.



The GS20 glass is particularly selective in its detection of thermal neutrons as shown graph (left) - the pulse height spectrum for GS20 glass with an example gamma background from ^{60}Co .

In applications where greater clarity of neutron signal is required, combinations of scintillators can be used.

AST's ^6Li enriched & ^7Li enriched glass forms have very similar properties – however the ^7Li forms have minimal neutron interaction.

Subtraction methodologies using both glass types can therefore produce highly

discriminating data, removing background gamma signal.

Most of our glass scintillators are made to order with a choice of finishes – as cast, fine ground or with some or all the surfaces polished for attachment to photomultiplier tubes. A number of standard size scintillators, to match the common diameters of photomultiplier tubes, are held in stock.

These products are manufactured to a high standard with tight tolerance specifications on a production basis working to our ISO9000:2000 approved systems. This provides you with a high performance product with a consistent security of supply provided by the constant availability of standard high quality materials.

