

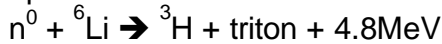
Lithium Glass (neutron and gamma characteristics)

Material background

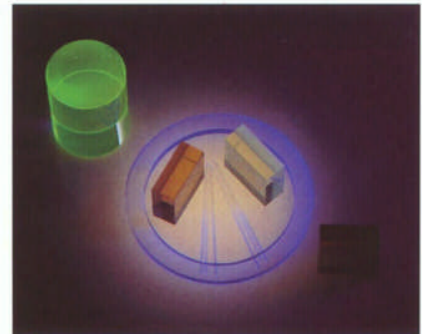
With an operating range from -200°C to 250°C coupled with being resistant to nearly all organic and inorganic chemicals (except hydrofluoric acid), AST's cerium activated lithium glass scintillators can be used in conditions which prohibit the use of other scintillation materials.

The 3 types of glass available are natural lithium based (GS1, GS10), ⁶Li enriched (GS2, GS20, KG2) and ⁶Li depleted (GS3, GS30, KG3).

The neutron detection mechanism in ⁶Li enriched options is:

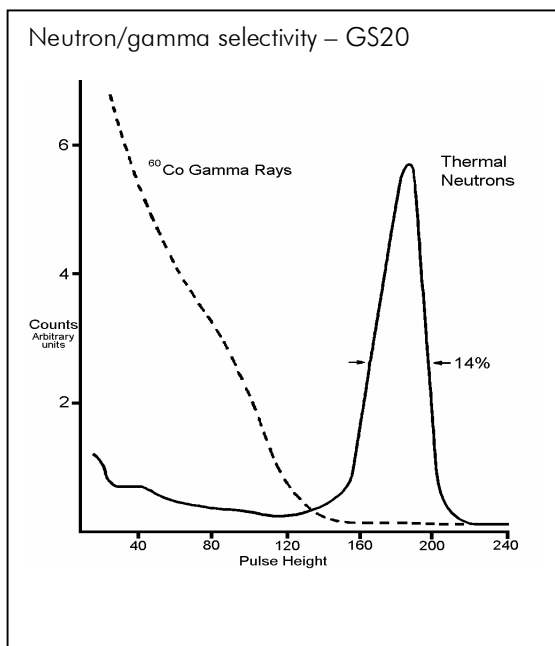


AST's ⁶Li glass thermal neutron scintillators can be selected to provide the neutron and gamma performance characteristics for individual applications.



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 across - the pulse height spectrum for GS20 glass with an example gamma background from ⁶⁰Co.

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.

Typical gamma sensitivities

Scintillator type and thickness	Gamma photons to give same light output as 1 neutron			Measured gamma attenuation coefficient* (M)		
	^{226}Ra	^{137}Cs	^{60}Co	^{226}Ra	^{137}Cs	^{60}Co
GS20; 1 mm	850	240	100	3.06	3.16	1.63
GS20; 1.5 mm	550	160	74	8.14	7.89	2.17
GS20; 3 mm	390	100	50	17.50	23.16	5.43
KG2L; 6.2 mm	310	81	57	37.80	33.69	25.00

* These values will be underestimated due to the detection of degraded Compton photons. The actual error will be greatest for the 1mm thick glass and smaller for the thick samples.



Glass/neutron energy selection table

Neutron Energy	Glass Type	Glass Thickness
0.01 - 20 eV	All types	0.1 - 10 mm
Thermal	GS20	1.3 mm
10 eV - 100 KeV	GS20	3.2 mm
100 eV - 1 MeV	GS20	25.4 mm
1 – 600 KeV	KG2, GS20	9.5 mm
1 - 6 MeV	GS20	25 mm