

Gamma-Neutron Ceramic Scintillator Properties

GLuGAG

Transparent Optical Ceramic

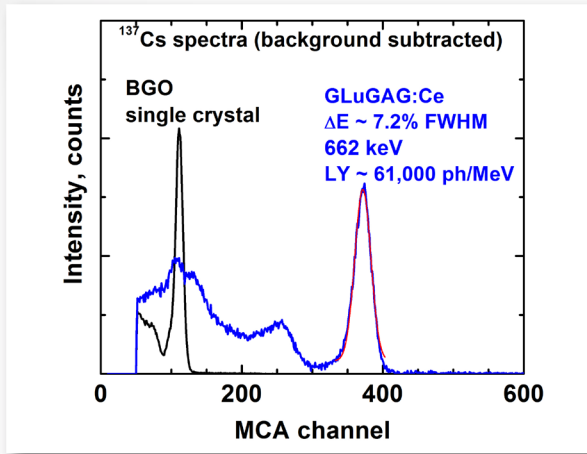
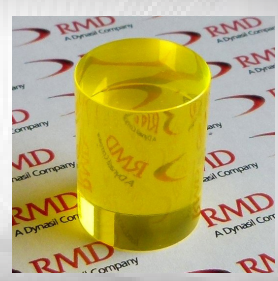
High Density

Coincidence Timing

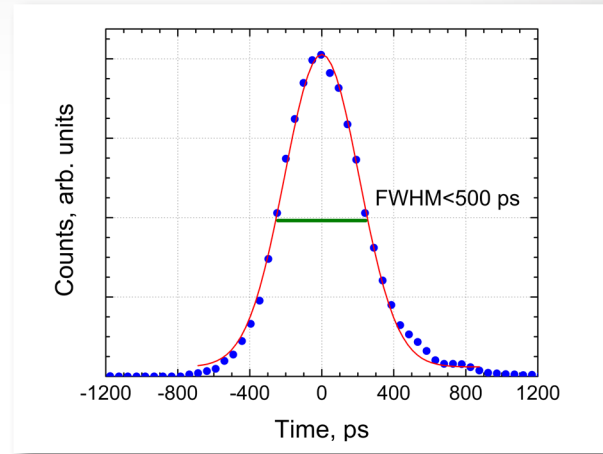
The Science Behind the Technology

 **RMD**
A Dynasil Company

Gamma-Neutron Ceramic Scintillation Detector



1" x 1"x 0.25" GLuGAG - Pulse Height Analysis



GLuGAG Timing Resolution

GLuGAG

(Gd,Lu)₃(Ga,Al)₅O₁₂:Ce (GLuGAG) is a gamma-ray scintillator from the garnet family. It has high light yield and density, good energy resolution, fast response, and good coincident timing resolution. These properties make it a very promising scintillator for high energy radiography and Position Emission Tomography (PET) applications.

High-energy radiography (in MeV range) requires high stopping power defined by high density and effective Z. GLuGAG offers a good combination of stopping power and light yield making it an excellent alternative for CsI(Tl), CdWO₄ and PbWO₄. Its low afterglow allows for high repetition rates.

Fast counting and positron emission tomography (PET) are additional applications for GLuGAG. High light yield combined with fast decay time can produce sub-nanosecond timing resolution,

currently benchmarked at approximately 500 ps (FWHM) using a PMT (improved results are expected utilizing red-sensitive SiPMs).

GLuGAG also can be used for neutron detection, as ^{nat}Gd has a high cross-section for thermal neutron absorption (48,890 barns). Thermal neutron capture generates a peak in the pulse height spectrum at ~70 keV. Thin layers of GLuGAG can be also be used for thermal neutron imaging.

GLuGAG is a stable and non-hygroscopic material. Its cubic crystal structure enables fabrication of large, uniform Transparent Optical Ceramic specimens. Current configurations include 1" x 1" right cylinders, 2.5" disks, 2"x 2"x 1.5" cuboid samples and arrays of different sizes for various applications.

Material	(Gd,Lu) ₃ (Ga,Al) ₅ O ₁₂ :Ce
Melting Point	1930°C
Density	6.8 g/cm ³
Crystal Structure	Cubic
Water Solubility	Insoluble
Emission Spectral Range	450-750 nm
Peak Scintillation Wavelength	545nm

Decay Constants (Ce3+)	75 ns, 190 ns, 1300 ns
Scintillation Light Yield	50,000 ph/MeV
GEE for Thermal Neutrons.....	71 KeV
X-ray Absorption Coef. at 100 KeV	12.6 cm ⁻¹
X-ray Absorption Coef. at 662 KeV	0.07 cm ⁻¹
Radiation Length	1.26 cm
Refractive Index.....	1.81±0.02 @480 nm