

Response of alpha particles in GAGG:Ce scintillators and correlation with non-proportionality patterns down to 0.1 keV

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The response of GAGG:Ce crystals with different Al/Ga ratio [1] to alpha particles, with the energies of 1.5 MeV up to 8.8 MeV, were studied in relation to that of gamma rays. It was done using ThC source and ²⁴¹Am source with Si absorbers. The alpha-to-gamma (α/γ) ratio, described as a ratio of the pulse amplitudes normalized to the energy unit, determined in relation to 662 keV gamma ray energy was also plotted versus a speed of the detected alpha particles and secondary electrons due to detected gamma rays. It allows to present a non-proportionality curve plotted vs velocity of detected particles covered response to alpha particles and gamma rays of a typical spectrometry range of 16 keV up to 1274.5 keV. Then, basing on alpha particle velocity, we calculated the energy of an electron, which would have the same velocity as the alpha particle. This technique was presented in [2], where scintillator was exposed to protons from cyclotron. In the presented study, use of alpha particles allows to get a non-proportionality characteristics of GAGG:Ce crystals down to about 0.1 keV of equivalent energy. The calculation provides new data and methods of scintillation non-proportionality characterization down to a very low energy with excellent precision, superior to these obtained with monochromatic synchrotron X-rays [3].

References

- [1] P. SIBCZYNSKI et al., "Characterization of GAGG:Ce scintillators with various Al-to-Ga ratio," vol. 772, pp. 112–117, 2015.
- [2] L. SWIDERSKI et al., "Common approach to study scintillators response to gamma-rays and protons," in 2014 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC), 2014, pp. 1–4.
- [3] I. V. KHODYUK et al., "Nonproportional Response Between 0.1 - 100 keV Energy by Means of Highly Monochromatic Synchrotron X-Rays," IEEE Trans. Nucl. Sci., vol. 57, no. 3, pp. 1175–1181, Jun. 2010.

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