Scintillation properties of GOS and GYAGG ceramics activated with cerium and praseodymium ions

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In this Communication we present a broader characterization of two different Gd-based ceramics from the point of view of their potential scintillator applications. The Gd_2O_2S (GOS) samples were doubly activated with Ce (0.003 mol%) and Pr (0.1 mol%) ions, whereas the GYAGG samples with Ce ions only, forming two compositions: $Ce_{0.006}Gd_{1.996}Y_{0.998}(Y_{0.02}Ga_{0.98})_2GaAl_2O_{12}$ and $Ce_{0.006}Gd_{1.996}Y_{0.998}(Y_{0.04}Ga_{0.96})_2GaAl_2O_{12}$. The following studies were performed: *i)* pulse height spectra as the basic measurement used to determine the values of scintillation light yield and energy resolution, *ii)* scintillation time profiles recorded to observe the kinetics of scintillation, *iii)* radioluminescence as a function of temperature to recognize the emission bands and their thermal dependences, *iv)* thermoluminescence to investigate the distribution of charge traps in the ceramics. We show that the GOS ceramics display reasonably high scintillation yields close to 30000 ph/MeV, but their scintillation is slow (a few μs), which is related to the intraconfigurational emission of Pr^{3+} ions. The strong point of the GOS ceramics is their thermal dependence of radioluminescence, since there is only a small thermal quenching at room temperature. Thermoluminescence shows distinct glow peaks and about 1/5 of charge carriers generated during X-ray excitation are captured by various kinds of traps. The GYAGG ceramics offer somewhat lower yields compared to GOS, but their scintillation, as based on the interconfigurational Ce^{3+} emission, is much faster. Unfortunately, as indicated by radioluminescence measurements, there is a relatively strong thermal quenching at room temperature. The glow curves of GYAGG are formed by less peaks than GOS, but still a similar amount of carriers is captured by traps. Summarizing, both ceramics have promising properties and could replace monocrystals in some applications related to radiation detection. Moreover, there is possibly plenty of room for improvement, therefore a further development of these ceramics is thinkable.

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