Effect of Mg-doping on cathodoluminescence properties of GAGG:Ce single crystalline films

O. Lalinský[1], P. Schauer[1], M. Kučera[2], Z. Lučeničová[2], M. Hanuš[2]

[1]*Institute of Scientific Instruments of the CAS, Královopolská 147, 612 64 Brno, Czech Republic*
[2]*Charles University, Faculty of Mathematics and Physics, 121 16 Prague, Czech Republic*

Cerium activated single crystals of gadolinium aluminum gallium garnet (GAGG:Ce) are prospective scintillation materials thanks to their high light yield of 50-60 kPh/MeV [1], and fast luminescence decay with a short decay time of 50-80 ns [2].
However, such decay time can be still too high, for example, for special SEM applications where the very fast e-beam scanning is required. Thus, new materials with faster decay have to be found.
For this purpose, Mg-doped specimens of the GAGG:Ce multicomponent epitaxial films with different concentration of Mg were grown from lead-free BaO-B_2O_3-BaF_2 flux. These films were excited by an electron beam with energy of 10 keV using a specialized CL apparatus [3]. As a result, CL spectra and CL intensity decays were measured in the temperature range between 100 and 500 K. Moreover, thermoluminescence glows were obtained.
One of the results was the decreasing decay time for the increasing Mg content. For the highest content of Mg, the decay time was under 29 ns. Thus, Mg-doped GAGG:Ce single crystalline films are perspective scintillators especially for applications, where very fast response is required.

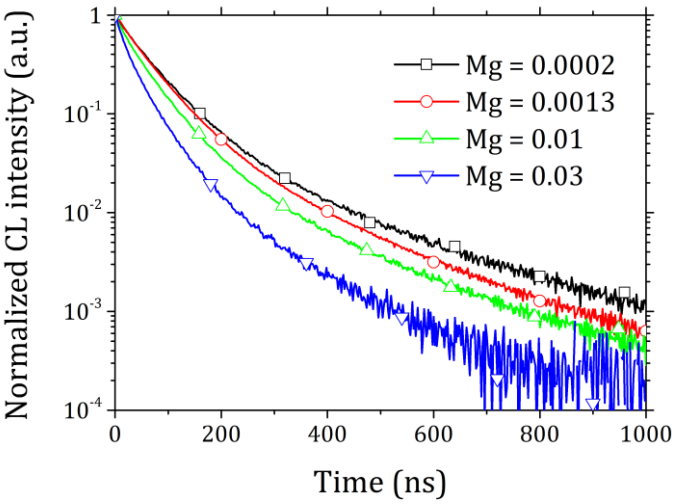

Fig. 1: CL decay characteristics of $(Ce_{0.03}Gd_{2.2}Lu_{0.8})(Al_{2.5-x}Ga_{2.5}Mg_x)O_{12}$ single crystalline films. Values of parameter x are shown in the graph legend. Electron pulses were 50 ns long.

Acknowledgements: The research was supported by Czech Science Foundation (project, GA16-05631S) by Ministry of Education, Youth and Sports of the Czech Republic (project LO1212). The research infrastructure was funded by Ministry of Education, Youth and Sports of the Czech Republic and European Commission (project CZ.1.05/2.1.00/01.0017).

[1] K. Kamada, T. Yanagida, T. Endo, et al., J. Cryst. Growth, **352,** 88 (2012).
[2] M. Kucera, Z. Onderisinova, J. Bok, et al., J. Lumin., **169**, 674 (2016).
[3] J. Bok, P. Schauer, Rev. Sci. Instrum., **82**, 113109 (2011).