Cathodoluminescence Performance of LuAG:Pr Single-Crystalline Films Optimized by Sc,Ga-codoping

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Pr^{3+}-activated lutetium aluminum garnet (LuAG:Pr) scintillator exhibits a broad emission band in the UV range between 300 and 400 nm and short decay time of ~20 ns, but also noticeable slow components caused probably by the antisite defects [1]. It was shown previously [1], that Ga-substitution suppressed these components, but also lowered scintillators' light yield. Also previously [2], the light yield was improved by 60-80% due to Sc-codoping in LuAG:Pr,Sc single crystalline films.

In this study, LuA(G)G:Pr,Sc single-crystalline films were grown by the liquid-phase epitaxy with various substituent concentrations. These specimens were studied by the spectrally-, time- and temperature-resolved cathodoluminescence (CL).

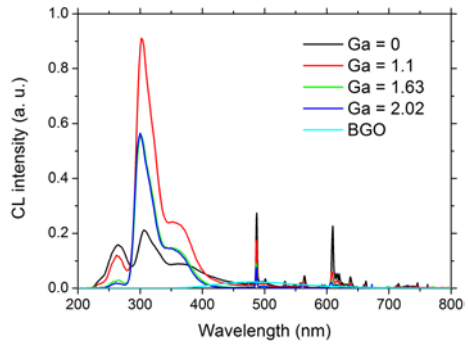

Fig. 1 Cathodoluminescence (CL) spectra of $(Pr_{0.005}Lu_3)(Al_{4.9-x}Ga_xSc_{0.1})O_{12}$ films.

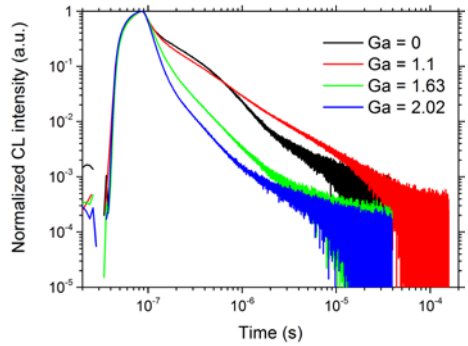

Fig. 2 CL decays (after 50 ns excitation) of $(Pr_{0.005}Lu_3)(Al_{4.9-x}Ga_xSc_{0.1})O_{12}$ films.

Due to slight (1.1) Ga substitution, the integrated CL intensity doubled (Fig. 1) and decay remained similar (Fig. 2) in comparison to Ga-free film. Higher Ga concentration lowers the afterglow, shortens the decay, somehow reduces CL intensity, which is, however, still slightly higher than that of Ga-free film.

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[2] Kucera et al., Journal of Crystal Growth, 318 (2011), 813–819