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Tb^{3+} AND Eu^{3+}-DOPED QUATERNARY GARNETS AS PHOSPHORS FOR HIGH-BRIGHT CATHODOLUMINESCENCE-BASED LIGHT SOURCES*

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Scintillators might be the pool of materials for choosing prospective phosphors with high radiation tolerance for application in cathodoluminescence (CL) light sources. In particular, radiation hard cerium-doped garnet-type single crystals are currently being successfully developed as scintillators for high-energy physics applications [1-3]. Quaternary garnets $(Gd,Y)_3Ga_3Al_2O_{12}$ (GYAGG) doped and codoped with Eu^{3+}, Tb^{3+} were fabricated as transparent and translucent ceramics by hot pressing to develop long-wavelength phosphors for high-brightness CL sources. The technique for obtaining ceramics is described in Ref. [1, 2]. The CL light yield of Tb-doped GYAGG ceramics at high-intensity electron beam excitation is shown to be more than twice as high as that of the conventional phosphor YAG:Ce, whereas codoping with Eu^{3+} allows to redshift the chromaticity.

In the present work, luminescence spectroscopic properties of GYAGG ceramics doped with Tb^{3+} and Eu^{3+} ions upon UV-, X-ray and cathode-ray excitation have been studied. In addition to observe behavior of defect-related luminescence, ceramics were irradiated with fast electrons (E = 10 MeV) from linear electron accelerator in UrFU, Yekaterinburg. A studies of the pulse CL decay kinetics show efficient non-radiative energy transfer between rare-earth ions $Tb^{3+} \rightarrow Eu^{3+}$ or $Tb^{3+} \rightarrow$ defects. Energy transfer is observed both from the $^5D_3$ level and from the $^5D_4$ level of the Tb^{3+} ion, and the energy transfer rate depends on the Eu^{3+} acceptor concentration. Forming point defects are produced by impact mechanism – elastic collisions. The luminescence spectra and decay kinetics of pulsed CL for some studied ceramics are shown in Fig. 1. The characteristic decay time and the type of electronic transitions are indicated.

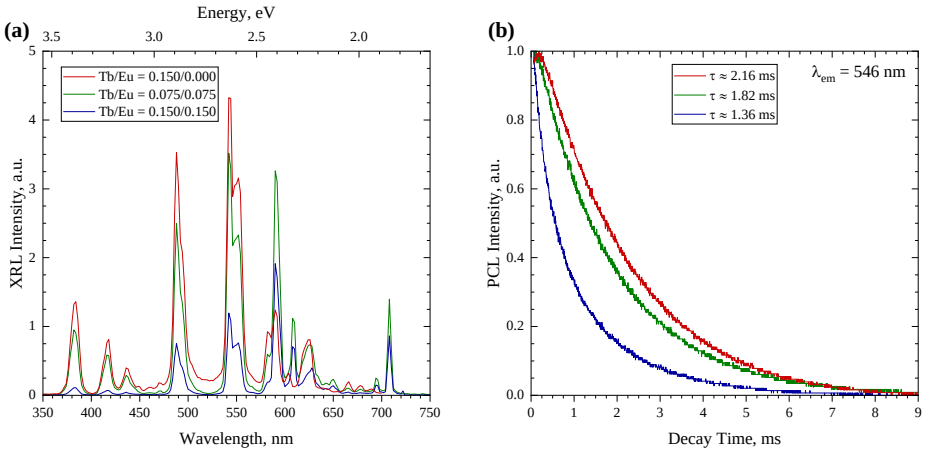

Fig. 1. X-ray excited luminescence spectra (a) and PCL decay kinetics (b) of GYAGG ceramics doped with Tb^{3+} and Eu^{3+} ions

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