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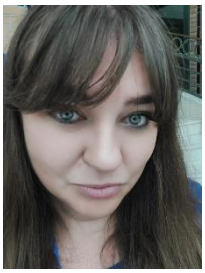

Oxyfluoride Glass-Ceramics Doped with Ytterbium, Erbium and Thulium Ions as Efficient Up-Conversion Light Converters

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Biography

I received the Ph.D. in Technology of silicate and refractory non-metallic materials in 2010. My studies have mainly focus on the development, synthesis, and investigations of the glass, glass-ceramics, and ceramics. The synthesis methods based on the melt-quenching technique and colloid-chemical approaches are the main techniques used in the work. My last studies have focused on the synthesis and investigation of luminescent materials in form glass glass ceramics and glassfiber. The results have published in ranked international journals.

Abstract

Oxyfluoride glass-ceramic materials activated by rare earth ions are effective up-conversion converters of IR radiation into the visible region of the spectrum. Such materials are of considerable interest for applications as secondary radiation sources in lighting devices and information display systems.

This paper presents the results of a study of the spectroscopic characteristics of glass-ceramic materials based on $PbO–PbF_2–CdF_2–GeO_2–SiO_2$ glass with Yb^{3+}, Er^{3+} and Tm^{3+} ions. Glasses of this composition were subjected to secondary annealing in the temperature range of 390 – 415 ºC for 5-15 h. As a result, glass-ceramic materials with a β-PbF_2 crystalline phase were obtained. It is shown that the spectrum of up-conversion luminescence of Er^{3+} and Tm^{3+} ions, upon excitation into the absorption line of Yb^{3+} ions (≈970 nm), significantly depends on the secondary heat treatment regime and the content of rare earth ions. For example, at a molar content of YbF_3 – 1.0%, Er_2O_3 – 0.01% and Tm_2O_3 – 1.0%, secondary heat treatment at 415 ºC for 5 h leads to the predominance of lines in the red region of the spectrum, 650 nm (1G4→3F4, Tm^{3+}) and 700 nm (4F9/2→4I15/2, Er^{3+}) in the spectrum of up-conversion luminescence. During secondary heat treatment at 385 ºC for 10 h, the luminescence spectrum is dominated by the line in the blue region of the spectrum, 475 nm (1G4→3H6, Tm^{3+}). Thus, variation of the composition and heat treatment regime of the oxyfluoride glass-ceramic material allows changing the spectral composition of the up-conversion luminescence of glass-ceramic samples.