INHOMOGENEITY OF THE YAG:CE CERAMICS SYNTHESIZED BY ELECTRON BEAM ASSISTED.

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This paper presents the results of studies of the luminescent characteristics of 4 series of samples: , YAG:Ce ceramics synthesized in the field of high-power electron fluxes aimed at establishing the reproducibility of the synthesis results.

Introduction

In [1] it is shown that the luminescent properties of YAG:Ce ceramic phosphors, ceramics depend on the background of the materials. The fact is that the synthesis of materials consists in the formation of YAG:Ce structures from a set of precursors characterized by low reactivity. When using solid-state reactions, high temperatures are required, not lower than 1600-1800 °C. To reduce the synthesis temperature, solid-state reactions are converted to liquid-phase ones. To ensure good mixing of the initial composition, techniques are used to ensure uniformity of the mutual distribution of components at the stage of charge formation [2-4]. For heating during synthesis, it is proposed to use well-controlled methods of laser exposure [5]. However, complex synthesis modes under extreme thermal conditions do not provide a sufficiently good reproducibility of the luminescent properties of phosphors. Therefore, work continues to improve existing synthesis technologies and develop new ones.
A new approach to the synthesis of refractory oxide materials using radiation technologies is interesting. In [6-7] it is shown that the YAG:Ce ceramics can be synthesized from a mixture of metal oxides by directly affecting the charge with a powerful stream of high-energy electrons..

Methods and materials

For synthesis, a charge was prepared from a mixture of powders of oxides Al2O3, Y2O3, Gd2O3 and Ce2O3 of the XCH grades. The ratio of oxides in the charge corresponded to stoichiometric. The type of samples in the crucible is shown in Fig. 1. 4 series of samples with different initial composition were synthesized for research (table 1). The series of samples differed in the concentrations of Ce activator and Gd modifier introduced into the charge.

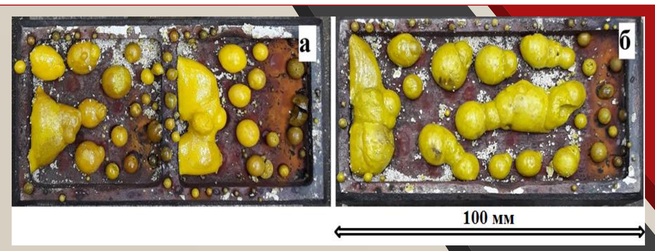

Fig. 1. Photo of samples:YAG:Ce of ceramics in the crucible.

TABLE 1. COMPOSITION OF THE CHARGE FOR SAMPLE SYNTHESIS.

№	content
35	Al_2O_3 (42,1%) + Y_2O_3 (55,9%) + Ce_2O_3 (2%)
36	Al_2O_3 (41,3%) + Y_2O_3 (54,7%) + Ce_2O_3 (4%)
37	Al_2O_3 (39,5%) + Y_2O_3 (52,5%) + Ce_2O_3 (2%) + Gd_2O_3 (6%)
38	Al_2O_3 (38,7%) + Y_2O_3 (51,3%) + Ce_2O_3 (4%) + Gd_2O_3 (6%)

Results and discussion

The most significant luminescent properties for luminescent materials were studied: the luminescence and excitation spectra, the kinetics of luminescence attenuation, and the energy output of converting the excitation energy into luminescence.

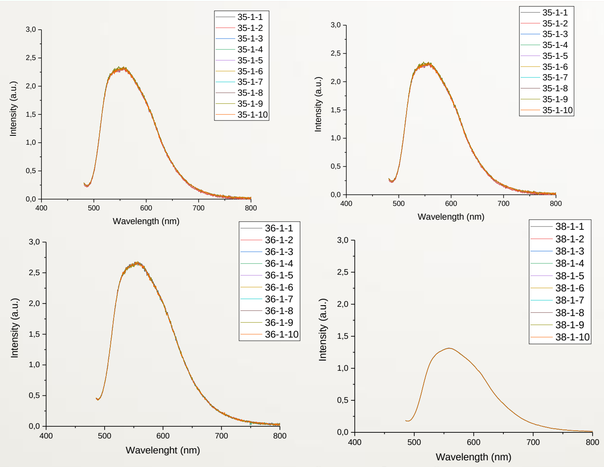

Fig. 2 Luminescence Spectra of samples of series 35,36,37,38 when excited by chip radiation at 450 nm.

For a visual representation, see Fig.3 shows all the results of measurements of the position of the luminescence bands of samples of the 35 series. As you can see, for 10 measurements of any sample, the measurement results differ less than for different samples of this seriesc

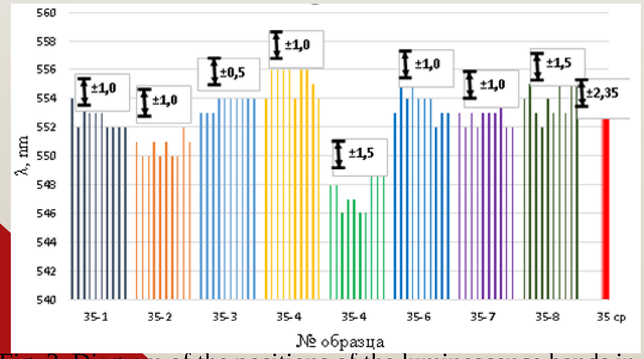

Fig. 3. Diagram of the positions of the luminescence bands in samples of the 35 series for 10 measurements of each sample.

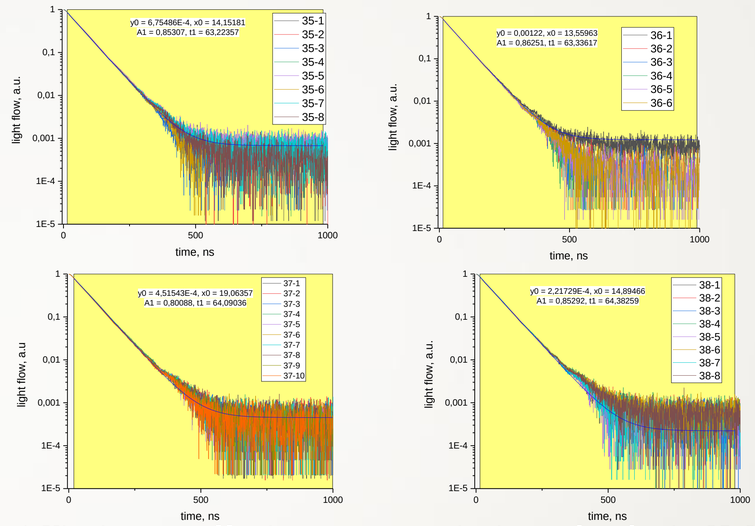

Fig. 4. Kinetic curves of luminescence attenuation in samples of series 35, 36,37, and 38.

For a visual representation, see Fig.3 shows all the results of measurements of the position of the luminescence bands of samples of the 35 series. As you can see, for 10 measurements of any sample, the measurement results differ less than for different samples of this series

Conclusion

The performed studies have shown that there are differences in the luminescent characteristics of samples of the same series that exceed the measurement error. Differences in luminescence characteristics are different in samples of different series, but do not exceed 1.5% for the position of the bands, 0.04% for the half-width, 0.8% of the decay time

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