Preparation of powdered luminescent materials based on yttrium oxide and yttrium-aluminum garnet by a new combustion method

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A new method of luminescent powders, based on the nitrate salts combustion in the presence of complex organic fuel (urea and hexamethylenetetramine, HMTA) was developed. The modes of synthesis are optimized and structural and spectral-luminescent characteristics of the ultra-dispersed powders of Y_2O_3:Bi, Eu and $Y_3Al_5O_{12}$:Ce, with the sizes of 0.8-1.2 μ were studied. The precursors were characterized by DTA and TG analysis and so prepared products – by X-ray diffraction (XRD), scanning electron microscopy (SEM), and IR spectroscopy. Doping of yttrium-aluminum garnet with cerium at excitation 450 nm causes broadband luminescence in the range of 480-700 nm, additional processing of powders in the air at 900-1100°C leads to a decrease in the luminescence intensity by 1.5 as compared with phosphor received by burning at 650 C, owing to formation of Ce^{4+} ions in a structure of $Y_3Al_5O_{12}$ under heating.

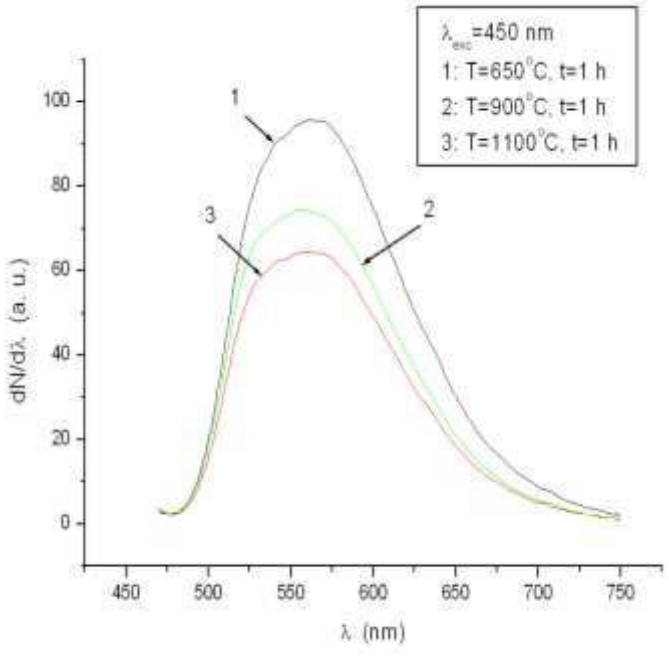

Fig. Luminescent spectra of $Y_3Al_5O_{12}$:Ce

Y_2O_3:Bi^{3+}, Eu^{3+} phosphors were successfully synthesized by combustion method at low temperature (650°C) and in short reaction time. Photoluminescent spectra of Y_2O_3:Bi^{3+}, Eu^{3+} particles exhibited strong red luminescent colour with highest sharp band at 612 nm under excitation in ultraviolet at 254 and 394 nm.