

Photoluminescence Properties of La³⁺-doped BaY_{1.94}Eu_{0.06}ZnO₅ Phosphor Prepared using a Sol-gel Method

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Abstract

The La³⁺-doped BaY_{1.94}Eu_{0.06}ZnO₅ nano-crystal phosphors were prepared using a sol-gel method. The x-ray diffraction profiles show that all of the peaks are attributed to the BaY₂ZnO₅ phase when co-doped with the (La³⁺, Eu³⁺) ions. The broad band centered at 301 nm and the sharp peaks from 320 to 410 nm are attributed to the charge transition state (CTS) from O²⁻ to Eu³⁺ ions of the host lattice and the intra-4f forbidden transitions of Eu³⁺ ion, respectively. Under an excitation of 395 nm, the emission spectra of BaY_{1.94-x}La_xEu_{0.06}ZnO₅ samples exhibit a series of shaped peaks assigned to the ⁵D₀→⁷F_J (J=0,1,2,3,4) transitions. Luminescence from the higher excited states, such as ⁵D₁, ⁵D₂, and ⁵D₃, were also observed, even though the La³⁺ concentration was up to x=0.36. In the BaY_{1.94-x}La_xEu_{0.06}ZnO₅ phosphor, different La³⁺ concentration did not change the locations of these excitation and emission peaks, but did change the intensities of them. The intensities of excitation and emission peaks increase and then decrease, when the La³⁺ ion concentrations are increased, and the maximum intensities for both the peaks occur when the x is 0.28. This may be due to the lattice distortion and induced an increase in the degree of compressive strain, which causes the amount of oxygen vacancies to decrease when the La³⁺ substitute the Y³⁺ ion.

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