Synthesis and properties of TbₓLa₁₋ₓInO₃ (x ≤ 0.15) indates

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In present work TbₓLa₁₋ₓInO₃ solid solutions with x = 0.03, 0.05, 0.07, 0.15 were synthesized by the ceramic method and their crystal structure, thermal expansion and thermal stability, magnetic susceptibility, IR-spectra, excitation and photoluminescence spectra were investigated.

It was found that in TbInO₃ – LaInO₃ binary system with x ≤ 0.15 there was a continuous range of TbₓLa₁₋ₓInO₃ solid solutions with the structure of orthorhombically distorted perovskite. IR-spectra of the samples investigated were found to be almost coequal.

Average coefficients of linear thermal expansion for the ceramic samples of TbₓLa₁₋ₓInO₃ solid solutions depend insignificantly on the substitution degree of Tb³⁺ ions by La³⁺ ions and vary without certain dependence from 8.11 · 10⁻⁶ K⁻¹, to 10.53 · 10⁻⁶ K⁻¹. When heating TbₓLa₁₋ₓInO₃ samples up to 1273 K no thermal effects were observed, total weight loss varied from 0.1325 to 0.3254 wt. % without a certain dependence on substitution degree x.

It was found that significant magnetic dilution of paramagnetic Tb³⁺ ions by diamagnetic La³⁺ ions leads to a decrease in effective spin-orbital magnetic moment of Tb³⁺ ions. This could be explained by an increase in «partial freezing» of orbital magnetic by crystal field of orthorhombically distorted perovskite.

It was found that Tb₀.₀₇La₀.₉₃InO₃ and Tb₀.₁₅La₀.₈₅InO₃ samples possess the highest photoluminescence intensity among all the TbₓLa₁₋ₓInO₃ solid solutions investigated (unlike it had been stated in [1]) and so they are established to be effective phosphors with visible green emission, hence, prospective for white LEDs (Fig.).

![Excitation and emission spectra](image_url)

Fig. Excitation (a) and emission (b) spectra of TbₓLa₁₋ₓInO₃ solid solutions with x = 0.05, 0.07, 0.15

References