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### **PHOTOLUMINESCENT PROPERTIES OF THE SOLID SOLUTIONS BASED ON LANTHANUM INDATE DOPED WITH PRASEODYMIUM, SAMARIUM, TERBIUM IONS**

The study of the physicochemical properties of solid solutions based on lanthanum indate  $\text{LaInO}_3$  doped with ions of rare earth and a number of other elements, including transition elements, is an urgent scientific and practical problem [1–3]. Solid solutions of composition  $\text{La}_{1-x}\text{Ln}_x\text{InO}_3$ , where  $\text{Ln}$  is a rare-earth ion, are promising magnetic and photoluminescent materials for the development of microelectronics, spintronics and optoelectronics devices. In [3], the photoluminescence excitation spectra and photoluminescence spectra of  $\text{LaInO}_3: \text{Ln}^{3+}$  ( $\text{Ln} = \text{Sm}, \text{Pr}, \text{Tb}$ ) solid solutions obtained by the sol–gel method, which exhibit red-orange, blue-green, and green photoluminescence, respectively, upon excitation by ultraviolet radiation, were

studied. However, only a small number of works are devoted to the synthesis and study of the properties of photoluminophores based on lanthanum indate doped simultaneously with several different rare-earth ions emitting red, green, and blue light.

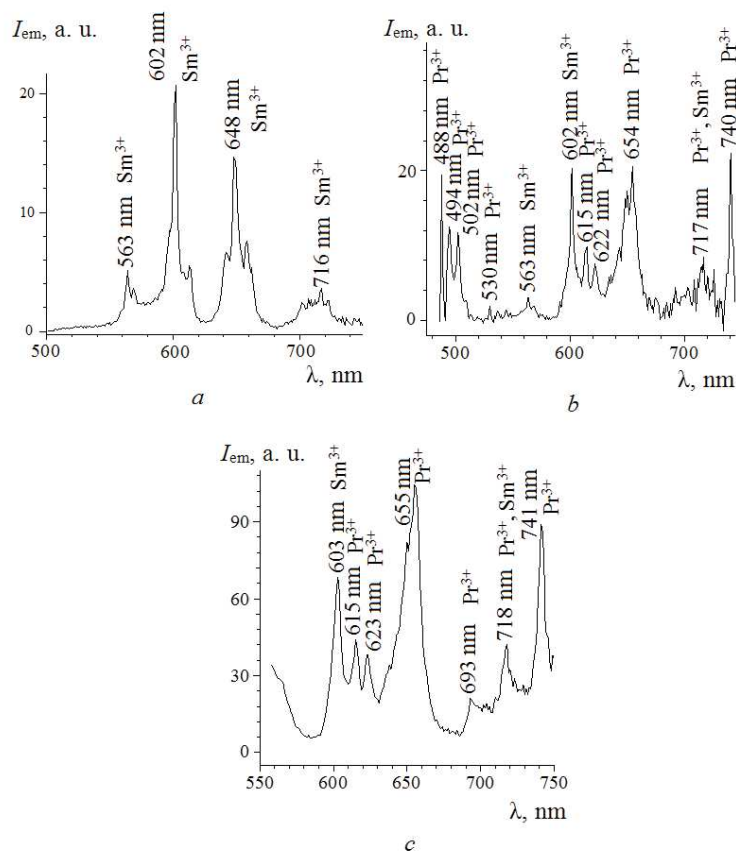
In this work, we study the photoluminescent properties of ceramic samples of solid solutions based on lanthanum indate doped with one or simultaneously several ions of the rare earth elements Pr, Sm, and Tb.

The samples were synthesized by the ceramic solid-phase method from the corresponding high-purity oxides. Oxides of lanthanum and rare earth elements were preliminarily calcined in air at a temperature of 1273 K. Measurements of photoluminescent properties were conducted in the Institute of Physics named after B.I. Stepanov of National Academy of Sciences of Belarus. Modernized spectrometry complex SDL-2 (LOMO, USSR) was used for investigations.

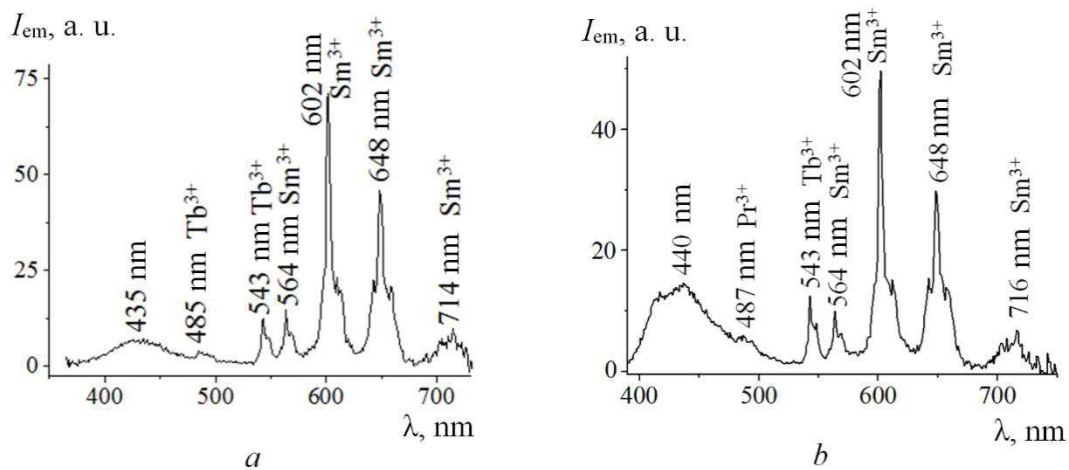
In the photoluminescence spectrum of  $\text{La}_{0,977}\text{Pr}_{0,003}\text{Sm}_{0,02}\text{InO}_3$  (Fig. 1 *a*), obtained at the excitation wavelength of samarium ions ( $\lambda_{\text{ex}} = 405$  nm), only photoluminescence bands of  $\text{Sm}^{3+}$  ions are observed, and there are no photoluminescence bands of  $\text{Pr}^{3+}$  ions. In the photoluminescence spectrum of  $\text{La}_{0,977}\text{Pr}_{0,003}\text{Sm}_{0,02}\text{InO}_3$ , obtained at an excitation wavelength  $\lambda_{\text{ex}} = 470$  nm, at which the luminescence of both praseodymium and samarium ions is excited (Fig. 1 *b*), photoluminescence bands of  $\text{Pr}^{3+}$  and  $\text{Sm}^{3+}$  ions are observed. In the photoluminescence spectrum at  $\lambda_{\text{ex}} = 500$  nm, photoluminescence bands of  $\text{Pr}^{3+}$  (623, 655, 693, and 741 nm) and  $\text{Sm}^{3+}$  (603, 718 nm) ions are observed. Such a shape of the photoluminescence spectrum of  $\text{La}_{0,977}\text{Pr}_{0,003}\text{Sm}_{0,02}\text{InO}_3$  at  $\lambda_{\text{ex}} = 500$  nm is probably due to the fact that when this solid solution is excited by light with a wavelength of  $\lambda_{\text{ex}} = 500$  nm, the energy is preferentially absorbed by  $\text{Pr}^{3+}$  ions and, to a lesser extent, by  $\text{Sm}^{3+}$  ions.

An analysis of the photoluminescence spectrum of  $\text{La}_{0,92}\text{Sm}_{0,02}\text{Tb}_{0,06}\text{InO}_3$  at  $\lambda_{\text{ex}} = 320$  nm (Fig. 2 *a*) shows that it simultaneously contains photoluminescence bands of  $\text{Sm}^{3+}$  ions and bands of  $\text{Tb}^{3+}$  ions with  $\lambda_{\text{max}} = 543$  nm (green region of the visible spectrum).

In the photoluminescence spectrum of  $\text{La}_{0,917}\text{Pr}_{0,003}\text{Sm}_{0,02}\text{Tb}_{0,06}\text{InO}_3$ , obtained at  $\lambda_{\text{ex}} = 320$  nm (Fig. 2 *b*), there are intense photoluminescence bands of  $\text{Sm}^{3+}$  and  $\text{Pr}^{3+}$  ions, as well as bands of  $\text{Tb}^{3+}$  ions, the intensity of which is much lower.



**Figure 1 – Photoluminescence spectra of  $\text{La}_{0.977}\text{Pr}_{0.003}\text{Sm}_{0.02}\text{InO}_3$  at  $\lambda_{\text{ex}} = 405 \text{ nm}$  (a),  $470 \text{ nm}$  (b) and  $500 \text{ nm}$  (c)**



**Figure 2 – Photoluminescence spectra of  $\text{La}_{0.92}\text{Sm}_{0.02}\text{Tb}_{0.06}\text{InO}_3$  (a) and  $\text{La}_{0.917}\text{Pr}_{0.003}\text{Sm}_{0.02}\text{Tb}_{0.06}\text{InO}_3$  (b) at  $\lambda_{\text{ex}} = 320 \text{ nm}$**

The results obtained in the work can be used in fundamental and applied scientific works devoted to solving the problems of physics and chem-

istry of magnetic materials, photoluminophores based on  $\text{LaInO}_3$  with a perovskite structure doped with ions of rare earth elements, and their use in the manufacture of white light LEDs and other electronic devices technology.

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### **ХИМИЧЕСКОЕ ОБОГАЩЕНИЕ ПЕРВИЧНОГО КАОЛИНА МЕСТОРОЖДЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ «ДЕДОВКА»**

Целью процесса химического обогащения каолинов является, в первую очередь, наиболее полное удаление красящих соединений. Применительно к белорусским каолинам данный метод наиболее актуален, т.к. природные запасы нежелезненного и маложелезистого сырья крайне ограничены. Усредненные значения железосодержащих примесей составляют в пересчете на  $\text{Fe}_2\text{O}_3$  0,46 масс. % для природного каолина и 1,05 масс. % для гидравлически обогащенной ситовым кондиционированием каолиновой суспензии.

Анализ данных [1, 2] определяет этот способ как наиболее эффективный, однако необходимо учитывать влияние химических реагентов на физико-химические свойства обработанного каолина. Восстановление  $\text{Fe}^{3+} \rightarrow \text{Fe}^{2+}$  в каолине производили гидросульфитным отбеливанием в солянокислой среде по следующей методике.

В приготовленную каолиновую суспензию влажностью 60 масс. % вводили переменное количество концентрированной соляной кислоты (в количестве от 2 до 8 г на 100 г сухого вещества). После тщательного перемешивания в суспензию вводился гидросульфит