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# Comparative study of the luminescent properties of oxide compounds under synchrotron radiation excitation: $\text{Lu}_2\text{O}_3\text{:Eu}$ nanopowders, ceramics and films

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**Abstract.** The paper is dedicated to the comparative study of the luminescent properties of  $\text{Lu}_2\text{O}_3\text{:Eu}$  (5%) nanopowders, ceramics and film samples using excitation by the synchrotron radiation in the range of the fundamental absorption edge of  $\text{Lu}_2\text{O}_3$  host. The luminescence of  $\text{F}^+$  centers in the band peaked at 400 nm with a lifetime about of 1.4 ns was observed in  $\text{Lu}_2\text{O}_3\text{:Eu}$  nanopowder. We have also determined the energy of creation of excitons bound with the  $\text{F}^+$  centers in  $\text{Lu}_2\text{O}_3$  host which is equal to 5.36 eV. The notable differences in the luminescence properties of  $\text{Lu}_2\text{O}_3\text{:Eu}$  nanopowder, ceramic and film samples were found which are caused by involvement of the  $\text{F}^+$  centers at the grain boundaries of ceramics and surface of nanoparticles in the excitation processes of the  $\text{Eu}^{3+}$  luminescence in  $\text{Lu}_2\text{O}_3$  host. The positions of the high energy levels of the  $\text{Eu}^{3+}$  ions in  $\text{Lu}_2\text{O}_3$  matrix were determined in details. We have found also the energy of creation of excitons bound with  $\text{Eu}^{3+}$  in the  $\text{Lu}_2\text{O}_3$  host which is equal to  $E_{\text{ex}}(\text{Eu})=5.7$  eV at 8 K. Meanwhile, the differences in the  $E_{\text{ex}}(\text{Eu})$  values in  $\text{Lu}_2\text{O}_3\text{:Eu}$  nanopowders, ceramics and films were also observed to be caused by participation of the host defects and flux impurities in the excitation processes of the  $\text{Eu}^{3+}$  luminescence in these samples.

**Keywords:**  $\text{Lu}_2\text{O}_3$ ,  $\text{Eu}^{3+}$  dopant, nanopowders, ceramics and films, luminescence, excitons,  $\text{F}^+$  centers

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