

Luminescence properties of $\text{Ba}_2\text{La}_8(\text{SiO}_4)_6\text{O}_2: \text{Sm}^{3+}$ oxyapatite phosphors for near-UV-based solid-state lighting

Nisar Hussain¹, Irfan Ayoub^{1,4}, Sudipta Som², Vishal Sharma³, Seemin Rubab¹, Hendrik C Swart⁴, Vijay Kumar^{1,4#}

¹Department of Physics, National Institute of Technology Srinagar, Jammu and Kashmir - 190006, India

²Department of Physics, Shiv Nadar University Chennai, Rajiv Gandhi Salai (OMR), Kalavakkam – 603110 Tamil Nadu, India

³Institute of Forensic Science & Criminology, Panjab University, Chandigarh, 160014, India

⁴Department of Physics, University of the Free State, P.O. Box 339, Bloemfontein ZA9300, South Africa

Corresponding authors: hussainrana214@gmail.com (N. Hussain)

ABSTRACT

Phosphor materials are recognized as significant in designing different multicolor light-emitting diodes (LEDs). Among the different phosphor materials, silicate-based phosphors have attracted the attention of researchers because of their multiple crystal forms, strong chemical stability, and progressive applications in different domains [1]. In this study, a series of samarium (Sm^{3+}) doped silicate-based oxyapatite phosphor $\text{Ba}_2\text{La}_8(\text{SiO}_4)_6\text{O}_2:x\text{Sm}^{3+}$ ($x = 0.01\text{-}0.05$ mol%) was synthesized through the high-temperature solid-state method. Phase confirmation was assessed by X-ray diffraction (XRD) analysis. Also, the photoluminescence excitation (PLE) and emission (PL) spectra of the synthesized phosphors were studied in detail. Both the PLE and PL spectra possess multiple broadband peaks, with the most intense peaks at 407 nm and 600 nm, respectively. The luminescence studies have revealed the optimal doping concentration of Sm^{3+} at 4 mol%. Furthermore, the CIE coordinates of the synthesized phosphor were found to lie in the orange-reddish with increasing color purity (70.2%–95.9%) towards the reddish region with the ideal correlated color temperature (2090K). The obtained results clearly suggest that the synthesized phosphor $\text{Ba}_2\text{La}_8(\text{SiO}_4)_6\text{O}_2:x\text{Sm}^{3+}$ can be effectively used for different applications of LEDs in different fields, especially for display and lighting purposes.

Keywords: Oxyapatite, samarium, photoluminescence properties, light-emitting diodes.

References:

1. Luo X, Xie RJ. Recent progress on the discovery of novel phosphors for solid-state lighting. *Journal of Rare Earth*. 2020 May 1;38(5):464-73.

