Photoluminescence and Judd-Ofelt estimations of red-emitting Eu^{3+} doped $BaLa_2ZnO_5$ phosphor

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Herein, we report a series of red emitting Eu^{3+}-activated $BaLa_2ZnO_5$ phosphor synthesized via high temperature solid-state reaction technique. Phase confirmation and crystal structure were confirmed from the X-ray powder diffraction (XRPD) pattern. Bandgap of undoped and doped $BaLa_2ZnO_5$ phosphor was analyzed by diffuse reflectance (DR) spectra. Decreasing effect of bandgap due to Eu^{3+} doping was confirmed by applying Kubelka-Munk function to the diffuse reflectance (DR) spectra. Effect of doping on the surface morphology and elemental composition was verified through field emission scanning electron microscope (FE-SEM) and energy-dispersive spectroscopy (EDS), respectively. Using the near ultraviolet 329 nm excitation wavelength, the synthesized phosphor was found to exhibit strong red emission owing to the different $^5D_0 \rightarrow {}^7F_J$ transitions. The synthesized phosphor was found to exhibit concentration quenching phenomenon due to dipole-dipole interactions. Further, Judd- Ofelt (JO) analysis was carried out to reveal the coordination nature of the doping element in the host lattice. Excellent thermal stability was observed for the present phosphor and activation energy was observed as 0.64 eV. Excellent color purity (98-99.3%) and stable Commission Internationale de l'Elcairage (CIE) coordinates in the red region of gamut suggests that the synthesized phosphor material can act an efficient candidate for UV, blue LED chips, and an efficient component in fabricating white light-emitting diodes (wLEDs).

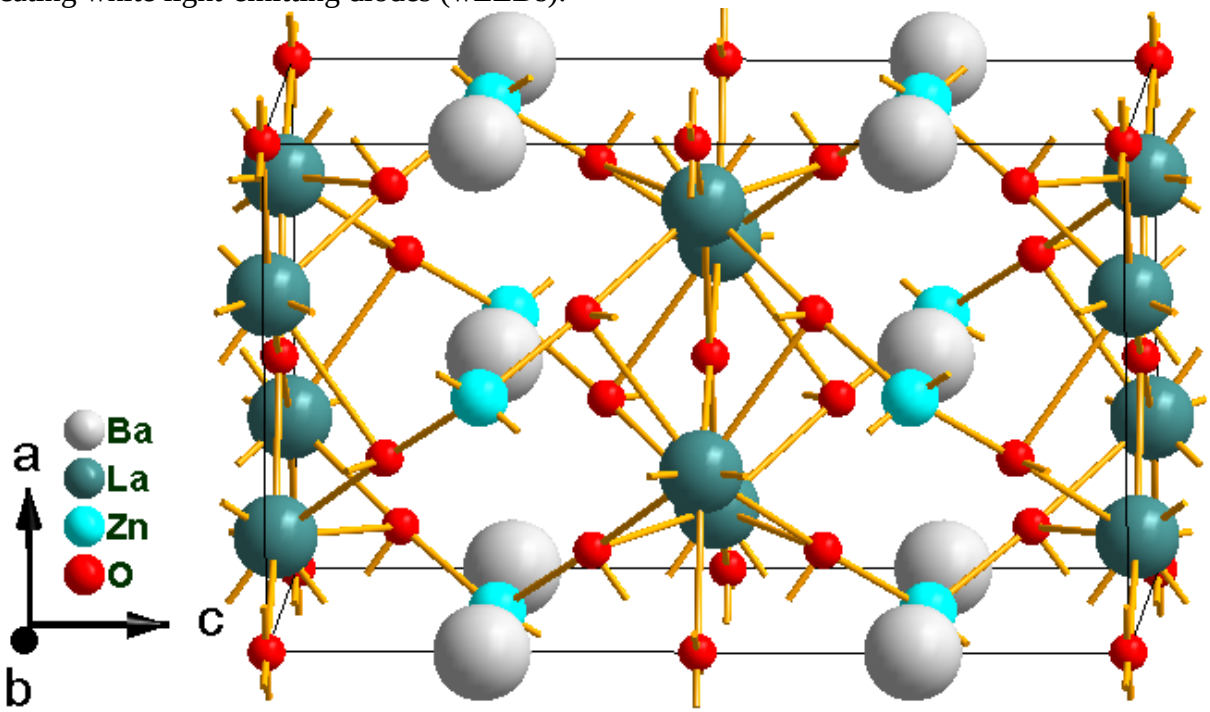

Fig. 1. Crystal structure of synthesized $BaLa_2ZnO_5$ phosphor developed using Diamond 4.5.2 software.