



# Luminescence Studies of rare-earth Ce<sup>3+</sup> and Dy<sup>3+</sup> doped SrAl<sub>2</sub>O<sub>4</sub> aluminate phosphors

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## ABSTRACT

The rare-earth doped Sr<sub>0.96</sub>Ce<sub>0.04-x</sub>Dy<sub>x</sub>Al<sub>2</sub>O<sub>4</sub> [ $x = 0.03, 0.02, 0.01$ ] aluminate phosphors synthesized by the high temperature solid-state reaction route are reported in this work. The phosphors under investigation were characterized for the structural and luminescence properties. The structural studies were carried out exploiting X-ray diffraction, Raman scattering technique, and the Fourier transform infrared spectroscopy. The optical study of the phosphors under observation comprises UV-Vis, thermoluminescence, and photoluminescence studies. The XRD results of these materials on analysis revealed that the samples exhibit double phase where dominating phase is that of desired Sr<sub>0.96</sub>Ce<sub>0.04-x</sub>Dy<sub>x</sub>Al<sub>2</sub>O<sub>4</sub> [ $x = 0.03, 0.02, 0.01$ ] phosphors with trace of secondary phase arising from unreacted SrCO<sub>3</sub>. The Sr<sub>0.96</sub>Ce<sub>0.04-x</sub>Dy<sub>x</sub>Al<sub>2</sub>O<sub>4</sub> [ $x = 0.03, 0.02, 0.01$ ] aluminates have acquired the monoclinic phase ( $P1\ 21\ n$ ) and SrCO<sub>3</sub> was found to have crystallized into the orthorhombic ( $Pnca$ ) phase. The characteristic Raman band at around  $\approx 460\text{ cm}^{-1}$  for Sr<sub>0.96</sub>Ce<sub>0.03</sub>Dy<sub>0.03</sub>Al<sub>2</sub>O<sub>4</sub> phosphor conveys the monoclinic structure in the sample. The UV-Vis spectral studies revealed the optical bandgap around 3 eV. Thermoluminescence study inferred the optimum intensity for 25-min exposure to the excitation radiation with higher intensity for  $x = 0.02$  (Dy/Ce) concentration. The photoluminescence studies revealed the emission in the blue region for  $x = 0.03$  and 0.02 confirmed from the CIE coordinate values and near red emission in the higher concentrated Ce<sup>3+</sup> ions.

## 1 Introduction

Luminescent materials (phosphors) emit light which they absorb when they are exposed to excitation source. These phosphor materials are classified according to their chemical nature, feasibility in the

application or in the sense of use of excitation source. From the excitation point of view, the various categorizes of luminescent materials are photoluminescent, thermoluminescent, cathodoluminescent, chemiluminescent, X-ray luminescent,

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