

Color tunable luminescence and Judo-Ofelt analysis for host sensitized Dy³⁺ doped Zinc Gallate phosphor

Umer Mushtaq^{1,*}, Vijay Kumar^{1,2}

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

²Department of Physics, University of the Free State, P.O. Box 339, Bloemfontein ZA9300, South Africa
Corresponding author email address: umernitsgr@gmail.com

Abstract

Series of single phase Dy³⁺ doped Zinc Gallate phosphor was synthesized using conventional solid state fabrication technique. For the quantification of structural properties of this phosphor X-ray powder diffraction (XRPD) and Rietveld refinement of host was performed and it was found to possess a space group of Fd3m with cubic spinel structure. By employing the XRPD line broadening, crystallite size of the fabricated material was calculated by using Scherrer's equation which was found to be 104 nm. Reflectance properties of the host were measured using UV-Vis spectroscopy and further the data obtained was employed to estimate the bandgap of all the synthesized samples using Kubelka-Munk function which was found to vary between 4.18 – 3.69 eV, thus confirming the formation of wide bandgap semiconductor. Morphological and compositional properties along with surface mapping was confirmed using field emission scanning electron microscope (FE-SEM), Energy dispersive electron spectroscopy (EDS) and time-of-flight secondary ion mass spectroscopy (ToF – SIMS). For the analysis of the luminescent properties of this phosphor PL excitation and emission spectra were recorded through which it was confirmed that after using the excitation wavelength of 247 nm all the samples recorded a broad host emission whose intensity displayed a decreasing trend while at the same time Dy³⁺ emission displayed increasing trend hence confirming the host sensitization in this phosphor. Emission obtained using this excitation was observed to shift from blue to white with increment in the doping concentration. 7 mol% concentration of Dy³⁺ was observed to match well with achromatic white (0.32, 0.33) on the color chromaticity diagram.

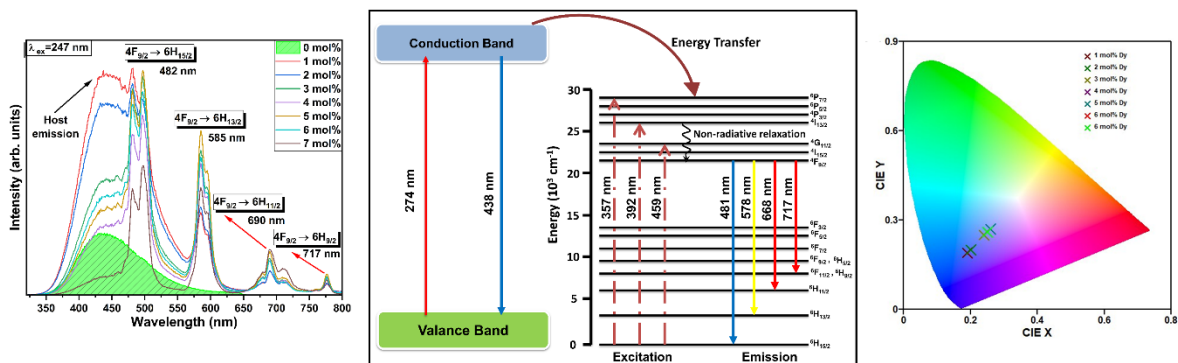


Figure 1: Luminescent properties of host sensitized Dy³⁺ doped zinc gallate phosphor.