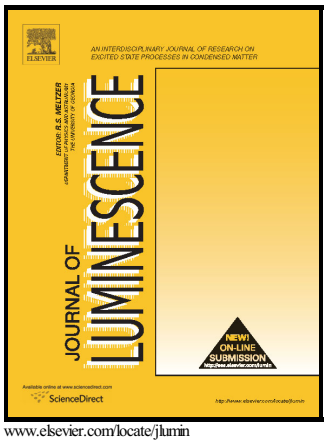
An insight into optical spectroscopy of intense green emitting $ZnAl_2O_4:Tb^{3+}$ nanoparticles: Photo, thermally stimulated luminescence and EPR study

Mithlesh Kumar, Santosh K. Gupta



www.elsevier.com/locate/jlumin

PII: S0022-2313(15)30011-9
DOI: http://dx.doi.org/10.1016/j.jlumin.2015.07.021
Reference: LUMIN13471

To appear in: *Journal of Luminescence*

Received date: 21 May 2015
Revised date: 29 June 2015
Accepted date: 16 July 2015

Cite this article as: Mithlesh Kumar and Santosh K. Gupta, An insight into optical spectroscopy of intense green emitting $ZnAl_2O_4:Tb^{3+}$ nanoparticles: Photo, thermally stimulated luminescence and EPR study, *Journal of Luminescence,* http://dx.doi.org/10.1016/j.jlumin.2015.07.021

An insight into optical spectroscopy of intense green emitting $ZnAl_2O_4:Tb^{3+}$ nanoparticles: Photo, thermally stimulated luminescence and EPR study

Mithlesh Kumar* and Santosh K. Gupta

Radiochemistry Division, Bhabha Atomic Research Centre,

Trombay, Mumbai-400 085, India

*Corresponding author: mithlesh@barc.gov.in, mithlesh010757@gmail.com

Telephone- +91-22-25594013

Fax- +91-22-25505151

Abstract:

Electron Paramagnetic Resonance, Photoluminescence and Thermally stimulated luminescence properties of un-doped $ZnAl_2O_4$ and Tb^{3+} doped $ZnAl_2O_4$ phosphors were investigated. The phosphors were synthesized at 1170 K via sol–gel route using the respective metal nitrates and citric acid. The nano-particle nature of the phosphor was confirmed by X-ray diffraction and Scanning Electron Microscope techniques. Time resolved photoluminescence and thermally stimulated luminescence spectroscopic techniques were used to characterize the emission and excitation properties of the system. The decay curve of Tb^{3+} had show single exponential behavior with λ_{em}=542 and λ_{ex}=230 nm. TSL glow curve of the $ZnAl_2O_4:Tb^{3+}$ nano-phosphor showed a single glow peak at 414 K with heating rate (β) = 1 K/s. The trap parameters such as activation energy and frequency factor for the glow peak were determined assuming the Arrhenius behavior for the system. Electron Paramagnetic resonance, technique was used to identify the chemical nature of the traps/ defects centers responsible for the glow peak. Detailed EPR–TSL correlation study confirmed the destruction of the hole trapped center to be responsible for the observed glow peak. Based on the findings, a probable mechanism was proposed for the glow peak. The emission spectrum of the nano-phosphor was plotted on a standard CIE diagram, which suggested a strong green emission from the phosphor.

Keywords: $ZnAl_2O_4$; Terbium; Photoluminescence; Thermally stimulated Luminescence; EPR

1. Introduction