

Zn₂TiO₄: Eu³⁺ Nanophosphor: Self Explosive Route and its near UV Excited Photoluminescence Properties for WLEDs

K.M. Girish ^{a,b}, Ramachandra Naik ^{b,c}, S.C. Prashantha ^{b,d,†}, H. Nagabhushana ^{e,†}, H.P. Nagaswarupa ^d, K.S. Anantha Raju ^d, H.B. Premkumar ^f, S.C. Sharma ^{g,1}, B.M. Nagabhushana ^h

^a Department of Physics, Dayanand Sagar Academy of Technology and Management, Bangalore 560082, India

^b Research and Development Center, Bharathiar University, Coimbatore 641046, India

^c Department of Physics, New Horizon College of Engineering, Bangalore 560103, India

^d Research Center, Department of Science, East West Institute of Technology, Bangalore 560091, India

^e Prof. CNR Rao Center for Advanced Materials, Tumkur University, Tumkur 572103, India

^f Department of Physics, Acharya Institute of Technology, Bangalore 560107, India

^g Chhattisgarh Swami Vivekanand Technical University, Bilai, CG 493441, India

^h Department of Chemistry, M.S. Ramaiah Institute of Technology, Bangalore 560 054, India

Abstract

A simple and low-cost solution combustion method was used to prepare Eu³⁺ (1–11 mol%) doped Zn₂TiO₄ nanophosphors at 500 °C using zinc nitrates as precursors and oxalyl di-hydrazide (ODH) as fuel. The final product was calcined at 1100 °C for 3 h and then characterized by powder X-ray diffraction (PXRD), fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and UV–visible absorption (UV–Vis). The PXRD patterns of the sample calcined at 1100 °C show pure cubic phase. The crystallite size was estimated using Scherrer's method and found to be in the range 20–25 nm and the same was confirmed by TEM studies. Effects of Eu³⁺ (1–11 mol%) cations on the luminescence properties of Zn₂TiO₄ nanoparticles were studied. The samples exhibit intense red emission upon 395 nm near ultra violet (NUV) excitation. The characteristic emission peaks recorded at ~578, 592, 613 and 654 nm may be attributed to the 4f–4f intra shell transitions (⁵D₀ → ⁷F_{j=0,1,2,3}) of Eu³⁺ cations. The CIE chromaticity coordinates and CCT were calculated from emission spectra and the values (x, y) were very close to NTSC standard values for red emission and CCT was close to Plankian locus. Therefore, the present phosphor may be highly useful for display applications.

Keywords

Zn₂TiO₄:Eu³⁺

Combustion technique

Nanophosphor

Photoluminescence