Facile combustion synthesized orthorhombic $GdAlO_3:Eu_{3þ}$ nanopho-sphors: Structural and photoluminescence properties for WLEDs

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Abstract

Nanoparticles of Eu^{3+} doped (1–11 mol%) $GdAlO_3$ were prepared using low temperature (350 °C) solution combustion technique with gadalonium nitrate as oxidizer and oxalyl di-hydrazide (ODH) as a fuel. The synthesized samples were calcined at 1000 °C for 3 h and used for Powder X-ray diffraction (PXRD), Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM) and UV–visible absorption (UV–vis) characterization techniques. A pure orthorhombic was obtained in calcined samples. The average crystallite sizes were estimated using Scherrer's formula, W–H and size–strain plots and found to be in the range 25–50 nm and the same was confirmed by Transmission electron microscopy (TEM) studies. The phosphors exhibit bright red emission upon 395 nm excitation. The characteristic emission peaks recorded at ~591, 612, 654 and 694 nm ($^5D_0 \rightarrow {}^7F_{j=1,2,3,4}$) were attributed to the 4f–4f intra-shell transitions of Eu^{3+} ions. The CIE chromaticity co-ordinates were calculated from emission spectra, the values (x, y) were very close to NTSC standard value of red emission. Further, the average CCT value was found to be ~2369 K, as a result the prepared nanophosphor was highly useful for red component of white light emitting devices and also for solid state display applications.

Keywords

$GdAlO_3:Eu^{3+}$

Combustion technique

Nanophosphor

Photoluminescence