Synthesis, characterization and optical properties of Eu^{3+} doped $MgZrO_3$ nanophoshor

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Abstract

A red light emitting Eu^{3+} doped $MgZrO_3$ nanophosphor was synthesized by combustion synthesis using carbohyrazide as organic fuel. The combustion process utilizes the enthalpy of combustion for the formation and the solid obtained was again fired at different temperature for 3hrs to increase the brightness and crystallinity. The advantages of short time reaction and low temperature solution based process have been exploited to produce $MgZrO_3$: Eu^{3+} nanoparticles. The synthesis conditions such as sintering temperature and dopant concentration were varied in order to determine the exact optimum conditions for synthesizing nanoparticles with superior optical properties and smaller particle size. The nanocrystals were characterized by X-ray diffractions (XRD), using scanning electron microscopy (SEM), transmission electron microscopy (TEM) and photoluminescence (PL) spectra. The results reveal the uniform spherical morphology with narrow size distribution. The average particle size of the synthesized nanophosphor was around 45-70 nm. Upon excitation by ultraviolet (UV) irradiation, the nanophosphor exhibit characteristic emission peaks due to the transitions between $^5D_0 \rightarrow {}^7F_j$ (j= 0, 1, 2, 3, and 4) stark split sub-levels of Eu^{3+} ion. The strong emission line at 612 nm corresponds to the forced electric dipole transition $^5D_0 \rightarrow {}^7F_2$.

Keywords: Nanophosphor, Combustion, $MgZrO_3$: Eu^{3+}