Re-revised manuscript

$Mg_2SiO_4:Tb^{3+}$ nanophosphor: Auto ignition route and near UV excited photoluminescence properties for WLEDs

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Abstract

For the first time nanoparticles of Tb^{3+} doped (1-11 mol %) Mg_2SiO_4 have been prepared using low temperature (350 ^oC) solution combustion technique with magnesium nitrate as precursor and oxalyl di-hydrazide (ODH) as fuel. The Powder X-ray diffraction (PXRD) patterns of the sample revealed orthorhombic structure with α-phase. The average crystallite size using Scherer's formula, W-H plot and Size-strain plot is found to be 28 nm and the same is confirmed by Transmission electron microscopy (TEM) studies. Scanning electron microscopy (SEM) pictures show a porous structure and the crystallites were agglomerated. The effect of Tb^{3+} cations on luminescence characteristics of Mg_2SiO_4 is studied and the results are discussed in detail. The phosphors exhibit bright green emission upon near ultra violet (NUV) 377 nm excitation. The characteristic photoluminescence emission peaks at 417, 436, 458 nm in blue region due to $^5D_3 \rightarrow {}^7F_j$ (j=5, 4, 3) of Tb^{3+} ions and the emission peaks at 486, 541, 584 and 621 nm in green region corresponding to $^5D_4 \rightarrow {}^7F_j$ (j=6, 5, 4, 3) transitions of Tb^{3+} ions owing to f-f transitions of Tb^{3+} cations in the given host lattice and are due to dipole-quadropole interactions. The CIE chromaticity co-ordinates are calculated from emission spectra and falls in green region. Therefore the present phosphor is highly useful for mercury free solid state lighting (SSL) and also for display applications.

Keywords: $Mg_2SiO_4:Tb^{3+}$ phosphor, Combustion technique, Nanophosphor, Oxalyl di-hydrazide, Photoluminescence, Commission International De I-Eclairage, Solid state lighting, Display applications.

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