Synthesis and luminescent properties of MAl_2O_4:Tb (M=Ca or Sr) nanocrystals

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Abstract

Rare earth activated multicomponent oxide phosphors have been widely investigated for application in display devices, lights and detectors. The green – emitting components of these types of lamps are based on Tb^{3+} ions, because it has a sharp emission around 545 nm with high intensity, which is close to the theoretical optimum wavelength for the green component of a tricolor lamp. Terbium activated MAl_2O_4:Tb nanocrystals where (M=Ca or Sr) were synthesized by combustion route using metal nitrates as precursors and urea as a fuel in a preheated furnace at 500^oC. The nanocrystals obtained through combustion synthesis were fired from 700^oC to 1100^oC for 3h to get better luminescent properties. These nanocrystals have been characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM) and x-ray diffraction (XRD) techniques. Nanocrystals have average size from 20nm to 50nm.The prepared nanocrystals under UV source revealed green luminescence that was attributed to the transitions from $^5D_4$ excited state to ^7F_J(J=3-6)ground state of Tb^{3+} ions. The predominant green colour from magnetic dipole transition $^5D_4 \rightarrow {}^7F_5$ of Tb^{3+} ions located at 546nm. In addition the dependence of the luminescence intensity on Tb^{3+} ions concentrations and effect of heat treatment on the particle size of the nanocrystals have also been discussed. Intensities of $^5D_4$ emissions increase with increase of sintering temperature while that of $^5D_3$ emissions decreases. The present work reports to achieve the homogenous incorporation of dopants and large scale productions of the nanophosphor in a short interval of time

Keywords: MAl_2O_4:Tb; Nanophosphors; Combustion synthesis; Urea; Green Luminescence