J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C8-114

Effect of varying La:S molar ratios in Eu_3^+activated La_2O_2S synthesized by sol-combustion method

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Nanopowders $La_2S_2O:Eu_3^+$ with different La(1:x):Sx molar ratios ($0.1<x<2.5$) has been synthesized by facile sol-combustion method. The crystal structure and optical properties were investigated by X-ray diffraction (XRD) patterns, Scanning electron microscope (SEM), Fourier transform infrared (FTIR), Ultra-violet visible (UV-Vis) spectroscopy and Photoluminescence (PL). As the ratio of La: S is varied (from 1.0 to 2.5), the $La_2S_2O:Eu_3^+$ nanopowder exhibits a body – centred cubic structure of La_2S_2O with formation of separated of EuO_2 and La_2O_2 phases which is confirmed by X-ray photoelectron spectroscopy (XPS). Fourier transform infrared also revealed the presence of La-S stretching mode, La – O and S-O vibration modes. UV-Vis reveals that the optical band gap of $La_2S_2O:Eu_3^+$ phosphors show red shift with increase in x. The PL spectra indicate several strong and narrow visible light emissions outspreading from 525 to 708 nm. The presence of Eu_3^+ impurities in the La_2S_2O structure induced the formation of recombination centres with lower emission energies and shows direct modulation of band gap. This method has proven to be ideal and simple to synthesize material for devices operating in the visible region as well as for developing heterojunction structures for optoelectronic device applications with desired efficiency.

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