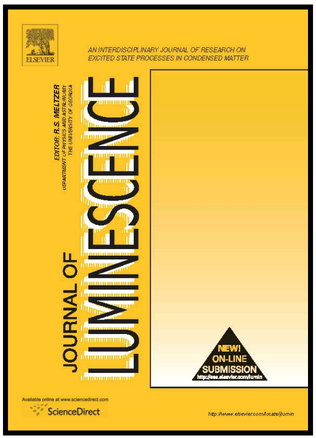

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Influence of local structure on luminescence dynamics of red emitting ZnO:Eu^{3+} nanostructures and its Judd-Ofelt analysis

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Abstract

Red emitting ZnO:Eu^{3+} nanostructures were synthesized by co-precipitation method. X-ray diffraction and Raman spectra indicated the formation of hexagonal wurtzite structure with preferential growth along (101) crystal plane. It is found that Eu^{3+} incorporation alter the morphology of the ZnO:Eu^{3+} nanostructures from rod to flower-like structures. The existence of trivalent europium ions in the ZnO lattice was confirmed by X-ray photoelectron spectroscopy. A defect-mediated energy transfer pathway from the ZnO host to the Eu^{3+} ions was identified in ZnO:Eu^{3+} nanoparticles, when excited with He-Cd laser of wavelength 442 nm. The observed intense red emission was due to intra 4f-4f transitions of Eu^{3+} ions. The emission intensity of ZnO:Eu^{3+} nanostructures was found to increase with europium content up to 2 at.% , beyond that quenching was observed and is attributed to the multipole-multipole interactions. Life time measurements of all samples revealed the single exponential behaviour of luminescence decay profiles. Higher value of Judd-Ofelt intensity parameter (Ω_2) and asymmetric ratio obtained indicated the reduction in symmetry around Eu^{3+} ions in these phosphors. CIE chromaticity and correlated color temperature analysis of these ZnO:Eu^{3+} nanoparticles have shown that the emission is in the red region with high color purity.

Graphical abstract