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Synthesis and characterization of Cerium III ion doped zinc selenide thin films prepared by chemical bath technique for luminescence application

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ZnSe:x% Ce³⁺ (x = 0, 2, 4, 6, 8 and 10) thin films were deposited using chemical bath technique. All the films samples revealed wurtzite phase ascribed to ZnSe and the presence of the Ce³⁺ did not change the films structure apart from the shift in peak position to longer wavelength when compared to the undoped sample. The red shift is due to the incorporation of the dopant ions into the host matrix. Raman spectroscopy revealed two optical phonon peaks due to first and second order longitudinal modes. The films samples showed flakes-like morphological while the presence of the anticipated elements was confirmed by energy dispersive X-ray spectroscopy. The cross sectional SEM morphology has shown increase in the thin films thickness with increased Ce³⁺ ion concentration. FTIR revealed O-H stretching vibration modes as well as inorganic bands attributed to ZnSe. Atomic force microscopy showed a decrease in surface roughness with increased Ce³⁺ concentration although with fluctuation. The ultraviolet-visible spectroscopy results showed increased band gap energy with an increase in Ce3+ concentration and the values were dependent on the crystallite size. The undoped sample showed three luminescence peaks, which are due to the band-to-band and defects within the host material. Although there was no evidence of emission from the Ce³⁺ ions, increasing the Ce³⁺ doping concentration resulted in enhancement of the emission peak intensities. The enhanced emission luminescence due to Ce³⁺ ion doping, wide band gap, the stable structure and morphology make the deposited thin films good candidates for optical applications especially in LEDs.

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