

PW-P014

Synthesis and Characterization Of Green- and Yellow-Emitting Zinc Silicate Thin Films Doped with Manganese

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Zinc silicate (Zn_2SiO_4) has been identified as a suitable host material for a wide variety of luminescent activators, such as transition metal and rare earth elements. In particular, manganese-activated Zn_2SiO_4 exhibits highly efficient photoluminescence and cathodoluminescence, which allows this material to be used in fluorescent lamps and display applications. In this study, we investigated the green and yellow luminescence from Mn-doped Zn_2SiO_4 thin films that were synthesized using radio frequency magnetron sputtering followed by annealing at $600\sim 1,200^\circ C$. The refractive index of the Zn_2SiO_4 : Mn films showed normal dispersion behavior. It was found that the Zn_2SiO_4 : Mn films annealed at $800^\circ C$ possessed a mixture of alpha and beta phases. The obtained photoluminescence spectrum consisted of two emission bands centered at 525 nm in the green range and 574 nm in the yellow range. The green luminescence originates from the divalent Mn ions in alpha phase of Zn_2SiO_4 , while the yellow luminescence comes from the divalent Mn ions in beta phase. The films annealed at and above $900^\circ C$ exhibited only the alpha phase. The broad PL excitation band was observed ranging from 220 to 300 nm with a maximum at around 243 nm.

Keywords: Zinc silicate, Photoluminescence, Cathodoluminescence, Manganese