

Structural analysis and photoluminescent study of thin film rhombohedral zinc orthosilicate doped with manganese

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In this study, structural properties and photoluminescent characteristics of thin film rhombohedral zinc orthosilicate doped with manganese ($Zn_2SiO_4:Mn$) were investigated. The $Zn_2SiO_4:Mn$ films showed a pronounced absorption edge in the near ultraviolet wavelength region and a high optical transparency in the visible spectral range. The maximum transmittance reached 0.922 at 597 nm, which was very close to the transmittance of the fused quartz substrate alone (0.935). The $Zn_2SiO_4:Mn$ films were composed of rhombohedral polycrystalline grains with random crystallographic orientation. The broad-band photoluminescence emission peaked at around 525 nm was observed from the $Zn_2SiO_4:Mn$ films, which was ascribed to the radiative relaxation from the 4T_1 lowest excitation state to 6A_1 ground state of $3d^5$ electrons in divalent manganese ion. The excitation band exhibited a peak maximum at 259 nm in the near ultraviolet region, which was considered to be associated with the charge transfer transition of divalent Mn ion in the Zn_2SiO_4 system.