PF-P039

Synthesis of rhombohedral-structured zinc germanate thin films and characteristics of divalent manganese-activated electroluminescence

Kyung Ho Yoon, Joo Han Kim*

Department of Advanced Materials Engineering, Chungbuk National University, 12 Gaeshin-dong, Heungduk-gu, Cheongju, Chungbuk 361-763, Korea

In this study, zinc germanate (Zn_2GeO_4) thin films has been synthesized by using radio frequency magnetron sputtering and the divalent manganese-activated luminescence was characterized. X-ray diffraction patterns of the as-deposited Zn_2GeO_4:Mn films showed only a broad feature, indicative of an amorphous structure. Scanning electron microscopy images revealed that the as-deposited Zn_2GeO_4:Mn has a smooth surface morphology. The Zn_2GeO_4:Mn films were found to be crystallized by annealing in air ambient at temperatures as low as 700°C. The annealed Zn_2GeO_4:Mn possessed a rhombohedral polycrystalline structure. The broad-band photoluminescent emission spectrum from 470 to 650nm was obtained at room temperature from the Zn_2GeO_4:Mn films. The emission peak was centered at around 535nm in the green range, which originates from the intrashell transition of manganese $3d^5$ electrons from $^4T_1$ excited-state level to the $^6A_1$ ground state. The PL emission spectrum had an asymmetric line shape, which results from the $3d^5$ electron transitions of divalent manganese ions located at different sites of the zinc germanate host crystal lattice. Electroluminescent devices were fabricated using Zn_2GeO_4:Mn as an emission layer. The fabricated devices showed a green EL emission similar to the PL emission. The CIE chromaticity color coordinates of the EL emission were determined to be x=0.308 and y=0.657.