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Influence of oxygen partial pressures on the structural and luminescence properties of pulsed laser deposited (Y-Gd)₃Al₅O₁₂:Ce³⁺ thin films

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Key words: Yttrium Gadolinium Aluminate; Oxygen pressure; Photoluminescence; Crystal field.

Abstract: Yttrium Gadolinium Aluminate doped with Cerium (Y-Gd)₃Al₅O₁₂:Ce³⁺ thin films were grown on silicon wafer substrate by pulsed laser deposition technique (PLD) under oxygen atmospheres and substrate temperature of 300 °C during the film deposition process. The effect of oxygen partial pressures on the structural and luminescence properties of the as-deposited thin films were analyzed. XRD pattern showed that with increasing oxygen background gas pressure, the peaks in the direction (420) shifted to higher two theta angles as compared to the powder samples. This could be attributed to induced crystal field effects on the host due to the different ionic sizes of Gd³⁺ (r = 105 nm) compared with Y³⁺ (r = 102 nm). Scanning electron microscopy (SEM) confirmed that oxygen background gas pressure affected the morphology of the films. The photoluminescence (PL) emission spectra showed a broad band emission ranging from 470 to 600 nm with a maximum at 545 nm when excited with 467 nm UV due to the 4f-5d electronic transition of Ce³⁺ attributed to the delocalization of electrons from the lowest 5d level to the crystal field split 4f (2F_{5/2}, 2F_{7/2}) levels of Ce³⁺. A slight shift in the wavelength of the PL spectra was observed from the thin films when compared to the PL spectra of the phosphor in powder form. The PL intensities of the films are generally low in all the (Y-Gd)₃Al₅O₁₂:Ce³⁺ thin films samples compared to those of the powder.

Reference: [1] S. Dlamini, H. C. Swart, J. J. Terblans, O. M. Ntwaeaborwa, Solid State Sci 2013; 23: 65–71.

Summary

N/A

Apply to be considered for a student & award (Yes / No)?

YES

Level for award (Hons, MSc, PhD, N/A)?

PhD

Main supervisor (name and email) and his / her institution

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**Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?**

YES

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