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Effect of substrate temperature on photoluminescence properties of Eu³⁺ doped BaZrO₃ thin films deposited by PLD

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Perovskite type (A²⁺B⁴⁺O²⁻₃)
structures are significantly important host for rare earth (RE) doping because they offer promising luminescence properties for light emitting diode, field emission display and all solid compact laser devices. Eu(³⁺ doped BaZrO₃ thin films with cubic structure were prepared on Si(100) substrates by using the pulse laser deposition (PLD) technique, using an Eu³⁺ doped BaZrO₃ target at 10 mTorr oxygen pressure. The substrate temperature was varied from 400℃ to 700℃. The thicknesses of the films were calculated from transmittance spectra. The thickness of all the films were around 300 nm. The phase identification and structural properties of the films were characterized by X-ray diffractometry. Surface morphology were studied by Scanning Electron Microscopy. Elemental analysis was performed using X-ray photoelectron spectroscopy (XPS). The oxidation states were also confirmed from XPS analysis. With the increase in substrate temperature, the growth of the films changed. Intense red emission was observed by the excitation of UV light. Emission spectra showed peaks at 577, 597 and 615 nm corresponding to the ⁵D₀⟶⁷F₀ , ⁵D₀⟶⁷F₁ and ⁵D₀ ⟶⁷F₂ transitions of Eu³⁺, respectively. It was observed that the emission at 597 nm which was due to the magnetic dipole transition (⁵D₀⟶<sup was the dominating emission. This confirms that Eu3+ ion occupied the centro-symmetric Zr(⁴⁺ site. Emission properties and defects involved within the films were investigated via photoluminescence.

Keywords: PLD, Thin film, Photoluminescence

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