

Structural, Photo and Thermoluminescence Studies of Eu³⁺ Doped Orthorhombic YAlO₃ Nanophosphors

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Abstract

A series of Eu³⁺ (1–6 mol%) activated YAlO₃ nanophosphors have been synthesized by a low temperature solution combustion method using ODH fuel. The structural, morphological, thermo and photoluminescent properties are studied. Powder X-ray diffraction patterns indicate that the phosphors are orthorhombic phase of YAlO₃ with small traces of Y₃Al₅O₁₂ phase. Scanning Electron micrographs show the crystallites are fused together to form dumbbell shape. Transmission Electron micrograph shows the crystallites are nano size in the range 30–45 nm. Photoluminescence studies of Eu doped YAlO₃ showed orange red emission (CIE co-ordinates $x = 0.645$, $y = 0.353$) due to the ⁵D₀→⁷F_{*j*} (*j* = 0, 1, 2, 3, 4) transitions of Eu³⁺ ions. The concentration quenching occurs at *x* = 5 mol%. YAlO₃:Eu³⁺(5 mol%) exhibit two thermoluminescence (TL) glow peaks around 229 and 324 °C respectively. TL response with different γ -doses show a good linear response and low fading suggesting that Eu³⁺ activated YAlO₃ is suitable for radiation dosimetry applications. The kinetic parameters (*E*, *b*, *s*) are estimated using peak shape method and discussed in detail.

Keywords:

Thermoluminescence

Phosphor

Eu³⁺

Rare-earth

Photoluminescence