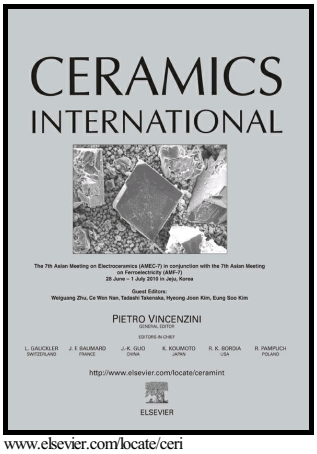

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Ultraviolet radiation excited strong red-emitting $LaAlO_3:Eu^{3+}$ nanophosphors: Synthesis and luminescent properties

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Abstract

We synthesized the trivalent europium ions (Eu^{3+}) doped lanthanum aluminate ($LaAlO_3$, LAO) nanophosphors by a solvothermal method. Their structural, morphological, and luminescent properties were systematically investigated. The obtained nanoparticles possessed single nanocrystallinity with a rhombohedral structure. For the excitation originating from the charge transfer band (O^{2-} to Eu^{3+} ions) under 320 nm illumination, the featured emissions of Eu^{3+} ions were detected in all the compounds. The optimum doping concentration of Eu^{3+} ions in LAO was about 9 mol% and the concentration quenching was dominated by dipole-dipole interaction. Furthermore, the Judd-Ofelt (J-O) theory was used to estimate the J-O intensity parameters. Based on the temperature-dependent PL emission spectra, the thermal stability was analyzed and the activation energy was obtained to be 0.234 eV. Meanwhile, the decay time, color coordinate/purity, and cathodoluminescence behaviors of synthesized nanophosphors were also studied. These characteristics make the Eu^{3+} doped LAO nanophosphors as promising red-emitting phosphors for both ultraviolet-based white light-emitting diodes and field-emission displays.

Keywords: Phosphors, Luminescence, Judd-Ofelt theory, Cathodoluminescence.