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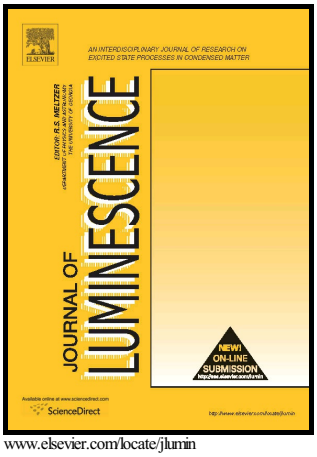

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High-efficiency and thermal-stable Eu^{3+}-activated $Ca_3Y(AlO)_3(BO_3)_4$ red-emitting phosphors for near-UV-excited white LEDs

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Abstract

Red-emitting $Ca_3Y(AlO)_3(BO_3)_4:Eu^{3+}$ (abbreviated as CYAB:Eu^{3+}) phosphors with different Eu^{3+} doping concentrations were synthesized by a conventional solid-state method and their crystal structure, morphology, luminescence properties, decay curves and quantum efficiency were investigated in detail. The CYAB:Eu^{3+} phosphors can emit red light peaking at ~621 nm under 397 nm excitation and the most intense red emission was obtained at the Eu^{3+} concentration of 50 mol%. From the concentration-dependent photoluminescence studies of CYAB:Eu^{3+} phosphors, the concentration quenching mechanism was dominated by dipole-dipole interaction. The as-prepared CYAB:0.5Eu^{3+} sample possessed good color coordinates of (0.653, 0.342) with high color purity of 90%. More importantly, the internal quantum efficiency of CYAB:0.5Eu^{3+} sample reached up to 88%. Furthermore, CYAB:Eu^{3+} exhibited good thermal stability and its emission intensity at 150 °C was still up to 76.3% of that at room-temperature. In addition, a prototype LED device was fabricated by coating a phosphor blend of $BaMgAl_{10}O_7:Eu^{2+}$ blue phosphors, $(Ba,Sr)_2SiO_4:Eu^{2+}$ green phosphors and CYAB:0.5Eu^{3+} red phosphors on the surface of 395 nm-emitting InGaN chip, which exhibited bright white light under 120 mA driven current. These good results indicate that the CYAB:Eu^{3+} phosphors are very appropriate red-emitting phosphors for applications in near-ultraviolet-excited white light-emitting diodes.

Graphical **Abstract**