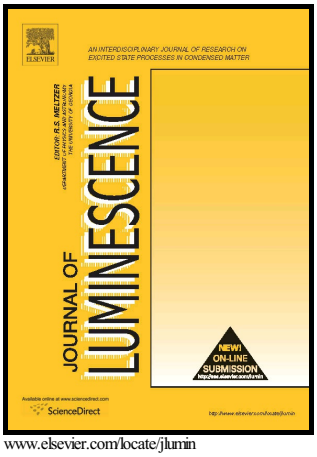

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Synthesis, luminescence properties and thermal stability of Eu^{3+}-activated $Na_2Y_2B_2O_7$ red phosphors excited by near-UV light for pc-WLEDs

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Abstract

In the present work, trivalent europium (Eu^{3+}) ion activated $Na_2Y_2B_2O_7$ red phosphors have been synthesized through high-temperature solid-state reaction. X-ray diffraction confirmed the successful formation of $Na_2Y_2B_2O_7$:Eu^{3+} phosphors with monoclinic phase. Under near-UV light (395 nm) excitation, $Na_2Y_2B_2O_7$:Eu^{3+} phosphors exhibited red emission around 619 nm due to the $^5D_0 \rightarrow {}^7F_2$ transition. The intensity of the $^5D_0 \rightarrow {}^7F_2$ transition increased with respect to Eu^{3+} ions concentration in $Na_2Y_{2(1-x)}B_2O_7$:xEu^{3+} ($0.05 \leq x \leq 0.5$) phosphors and the luminescence quenching was observed at x = 0.35. The critical distance (R_c) and θ were calculated to be 9.20 Å and 5.07, respectively, and thus the dipole-dipole interaction could play a significant role in concentration quenching. The lifetimes of the $Na_2Y_{2(1-x)}B_2O_7$:xEu^{3+} phosphors were calculated for various concentrations (x) of Eu^{3+} ions. In addition, the determined color purity of $Na_2Y_2B_2O_7$:$0.35Eu^{3+}$ phosphor was 98.2% and internal quantum efficiency was 36.6%. Temperature-dependent photoluminescence study showed that emission intensity at 423 K was 40.2% of its initial at room temperature. The calculated activation energy of the $Na_2Y_2B_2O_7$:$0.35Eu^{3+}$ phosphor was 0.16 eV. The above