

Influence of Sintering Temperatures in $\text{Er}^{3+}/\text{Yb}^{3+}/\text{Tm}^{3+}$ Tri-Doped Y_2O_3 Nanophosphors

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Abstract : The $\text{Er}^{3+}/\text{Yb}^{3+}/\text{Tm}^{3+}$ tri-doped Y_2O_3 nanophosphors were synthesized by solvothermal method and its temperature dependence of the white upconversion emission has been studied by using 975 nm laser diode. The upconversion emission spectra in 1 mol% $\text{Er}^{3+}/5$ mol% $\text{Yb}^{3+}/x\text{Tm}^{3+}$ tri-doped Y_2O_3 nanophosphors sintered at 1000 °C with x from 0 to 0.5 mol%. The blue emission intensity increase with Tm^{3+} concentration from 0 to 0.5 mol%, it is due to the $2\text{F}_{7/2} \rightarrow 2\text{F}_{5/2}$ transition of Yb^{3+} around 10,000 cm^{-1} could easily reach the Tm^{3+} states. The white light is composed with the blue ($1\text{G}_4 \rightarrow 3\text{H}_6$ of Tm^{3+}), green ($2\text{H}_{11/2}$, $4\text{S}_{3/2} \rightarrow 4\text{I}_{15/2}$ of Er^{3+}), and red ($4\text{F}_9/2 \rightarrow 4\text{I}_{15/2}$ of Er^{3+}) upconversion radiations. The $\text{Y}_2\text{O}_3: \text{Er}^{3+}/\text{Yb}^{3+}/\text{Tm}^{3+}$ nanophosphors show from white to green upconversion emission at power of 600 mW/cm^2 as sintering temperature increased. The calculated Commission Internationale de l'Eclairage (CIE) coordinates can be located in the white area with various sintering temperatures, in sintered at 1000 °C, and their color coordinates are very close to the standard white-light emission (0.33, 0.33). Their upconversion processes were explained by measuring the upconversion luminescence spectra and pump power dependence and energy level diagram.

Keywords : white upconversion emission, nanophosphors, energy transfer, solvothermal method

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