Down-conversion emission in Er^{3+}/Yb^{3+}-coped Sr_2CeO_4

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The intense technological development leaded to the study of new phosphors, for photonic applications since energy conversion to imaging generator devices. Rare earth ions (RE^{3+}) are highlighted due its intense photoluminescence and long decay lifetimes. Sr_2CeO_4 has excelled in the development of blue phosphors due to its characteristic emission with maximum around 470 nm[1].The Er^{3+} has characteristic emissions in the regions of the visible (green and red) and 1550 nm, when excited in the infrared region[1].Er^{3+} and Yb^{3+} when used together have a higher efficiency for the Yb^{3+} absorb more efficiently IR radiation. Studies reported that some host matrices lead these ions to exhibit properties of down-conversion.[2] In this work, we attempt to obtain Sr_2CeO_4 doped with Er^{3+} and Yb^{3+}. Sr_2CeO_4 was obtained by the combustion methods. Citric acid and solutions with Sr^{2+} and Ce^{3+} (Sr^{2+}:Ce^{3+}/66:33 mol%) were used as precursors. Under stirring and heating, a mass of citric acid twenty times the moles number of metals was added to the precursor solution. The Yb^{3+} amounts were fixed at 1.2 mol%, while the Er^{3+} concentration was varied at 0.5, 1.0, 3.0 and 5.0 mol%. After evaporation and reduction, the remaining volume was heat-treated at 1100 °C for 8 h. FTIR spectra show bands at 479, 853, 1029 and 1450 cm^{-1}, relating to the Sr_2CeO_4 characteristic bonds. XRD showed efficient formation of Sr_2CeO_4 and low formation of secondary phases. SEM analysis revealed that the particles have nanorods morphology, without influences of doping. When excited at 270 nm the emission spectra show emission in the blue region, with maximum at about 470 nm, related to Ce(IV) → O^{2-} charge transfer in Sr_2CeO_4. The emission spectra also showed bands at 525, 550 and 667 nm, assigned to $^4H_{11/2}\rightarrow{}^4I_{15/2}$, $^4S_{3/2}\rightarrow{}^4I_{15/2}$ and $^4F_{9/2}\rightarrow{}^4I_{15/2}$ Er^{3+} transitions, respectively.These Er^{3+} emissions reveal that Er^{3+} in Sr_2CeO_4 shows down-conversion properties, higher when Er^{3+} concentrations is 3.0 mol%. The emission bands assigned to Sr_2CeO_4 and Er^{3+} make that materials present chromaticity coordinates at bluish green region. The lifetime for Sr_2CeO_4 was estimated between 0.08 and 0.14 ms. The route described in this work make possible obtain Sr_2CeO_4 doped with Er^{3+} and Yb^{3+} efficiently. Er^{3+} presented down-conversion properties, property still not studied for Er^{3+} in the Sr_2CeO_4 matrix.

1Seo, Y. W. et al. *Ceram. Int.* **2015**, 41, 14332.

2Tamrakar, R. K. et al. *Luminescence*.**2015**, 30, 812.

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