Dependence of upconversion emission intensity on Yb^{3+} concentration in $Y_2(MoO_4)_3:Yb^{3+},Er^{3+}$

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Upconversion materials have been studied for many groups due to its optical properties. These luminescent materials can convert infrared radiation into visible light. And the applicability for them is very wide such as lasers, optical amplifiers, colour displays, solar cells and bio-imaging. The lanthanide-doped upconversion materials consist of host and trivalent rare earth ions doped. There are many studies with different hosts as oxides, molybdates, vanadates, phosphates, and fluorides. Moreover, one of the host most studied is the molybdate because it has a stable semioccupied d-orbital resulting on the lanthanide shielding. [1-3].

In this work, $Y_2(MoO_3)_4:Yb^{3+},Er^{3+}$ materials were synthesized by the co-precipitation reaction at room temperature, followed by annealing at 1050 °C. The Yb^{3+} and Er^{3+} concentrations were 1, 5 as well as 10 and 1 mol-% of the yttrium amount, respectively. The materials were characterised with X-ray powder diffraction (XPD), upconversion luminescence and decay time measurements.

The XPD analyses agrees with the ICDD PDF-00-028-1451 for the yttrium molybdate doped with Yb^{3+} and Er^{3+} (Figure 1). Under the 980 nm NIR excitation, a typical emission spectrum show the emission bands centred around $\lambda \sim 530$ nm attributed to $^2H_{11/2} \rightarrow {}^4I_{15/2}$, 550 nm attributed to the $^4S_{3/2} \rightarrow {}^4I_{15/2}$ and 654 nm attributed to $^4F_{9/2} \rightarrow {}^4I_{15/2}$ transitions (Figure 2). In contrast to only a slightly change in the green-to-red emission ratio between materials doped with 10 and 5 mol-% of Yb^{3+}, this ratio changed significantly for the 1 mol-% Yb^{3+} doping level. So, the material showed a green and red upconversion emissions and it was centred around 550 and 670 nm, respectively. Therefore, the $Y_2(MoO_3)_4:Yb^{3+},Er^{3+}$ materials exhibit green emission under infrared radiation and can be applied in several areas as lasers and optical biomarker.

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[2] G. Chen, H. Qiu, P.N. Prasad, X. Chen, *Chem. Rev.* **114** (2014) 5161-5214.