

Multicolor emission in single-phase $\text{Ca}(\text{MoO}_4)(\text{WO}_4):\text{Dy}^{3+}, \text{Eu}^{3+}$ materials prepared by rapid synthesis

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Solid state materials with dynamic emission colors form the basis of future smart lighting systems for a wide variety of everyday applications [1]. For this reason, the rare earth ions (RE^{3+}) doping materials overtake the design of such systems exhibit easy tuning of colors and likewise offer straightforward spectral interpretations with their narrow lines characteristics.

In this work we report preparation as well as the spectroscopic properties of the single phase new highly tricolor luminescent emitting of Eu^{3+} , Dy^{3+} codoped into the $\text{Ca}(\text{MoO}_4)(\text{WO}_4)$ host lattice. The materials were prepared at room temperature exposed to ultrasonic irradiation for 30 min from stoichiometry aqueous solutions of Na_2MoO_4 , Na_2WO_4 , CaCl_2 , EuCl_3 and DyCl_3 (X_{Dy} : 0.3; X_{Eu} : 0.1 mol% of the Ca^{2+} amount). The as prepared materials were washed with distilled water, filtered and after dried.

In the excitation spectrum, there is a broad band in the range 220–350 nm corresponding to the Ligand-to-metal charge transfer (LMCT) (Fig.). This band can be deconvoluted into two bands. The band located at 270 nm is due only to the charge transfer $\text{O}^{2-} \rightarrow \text{W}^{6+}$, whereas that centered at 300 nm indicates energy transfer from $\text{O}^{2-} \rightarrow \text{Mo}^{6+}$, and $\text{O}^{2-} \rightarrow \text{Eu}^{3+}$.

The emission arising mainly from the $\text{Dy}^{3+} {}^4\text{F}_{9/2} \rightarrow {}^6\text{H}_{15/2}$, ${}^6\text{H}_{13/2}$ and $\text{Eu}^{3+} {}^5\text{D}_0 \rightarrow {}^7\text{F}_2$, ${}^7\text{F}_4$ transitions are due to the 488, 575, 614 and 700 nm, respectively (Fig.). In the 353 nm excitation wavelength the phosphor exhibits warm white color emission.

These results suggest that $\text{Ca}(\text{MoO}_4)(\text{WO}_4):\text{Dy}^{3+}, \text{Eu}^{3+}$ could act as a multicolor phosphor in solid state-lighting technology.

Keywords: molybdate, tungstate, multicolor emission, europium, dysprosium, luminescence.

Acknowledgements: CNPq and CAPES.

Reference

[1] Laguna M., Nuñez N.O., Becerro A.I., Ocaña M.; CrystEngComm. (2017) 19, 1590

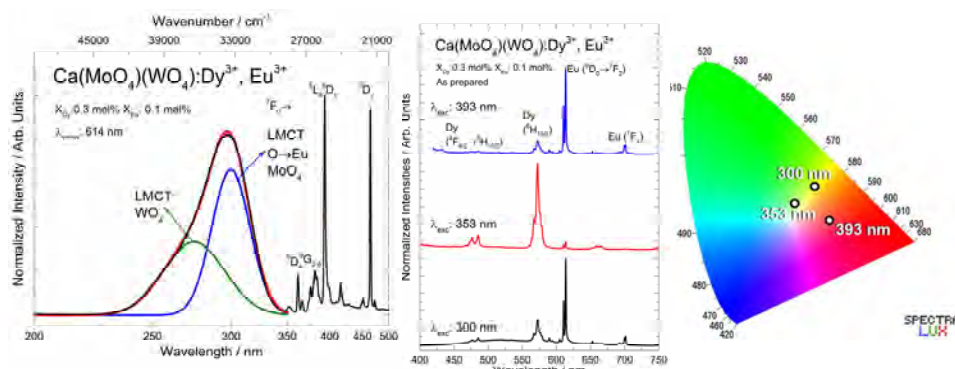


Fig. Excitation spectrum (left), Emission spectra (middle), CIE color coordinates (right) of the $\text{Ca}(\text{MoO}_4)(\text{WO}_4):\text{Dy}^{3+}, \text{Eu}^{3+}$ as prepared materials.