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BLUE LUMINESCENCE IN MWO₄:Tm³⁺ (M= Ba, Sr) PHOSPHORS

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Highly luminescent emission from trivalent rare earth (R³⁺) doped tungstates [WO₄]₂- have been extensively studied during the past century, especially on their very interesting luminescence, structural properties and electro-optical applications [1]. Nowadays they have awakened the curiosity of nano world. This work reports the investigation of MWO₄:Tm³⁺ (M=Ba, Sr) materials with blue emission luminescence prepared with a low cost and easy synthesis route. The materials were prepared by the co-precipitation method with stoichiometry aqueous solutions of Na₂WO₄, BaCl₂ or SrCl₂ and TmCl₃ (Tm³⁺ in 0.02 to 0.1 mol-% of the M²⁺ amount). The as-prepared materials were characterized by infrared spectroscopy showing strong vibrations in the range 700-1000 cm⁻¹ attributed to stretching vibration (ν) symmetrical and asymmetrical of the tetrahedral group (WO₄²⁻). The XRD measurements reveal that the majority phase is tetragonal scheelite phase with I41/a (#88) space group. The emission spectra of MWO₄:Tm³⁺ (M= Ba, Sr) materials are dominated by high intensity 1D₂→3F₄ transition in blue region (~452nm) and ¹G₄→³H₆ (~475nm) and also other transitions of Tm³⁺, in red ¹G₄→³F₄ (654 nm) and close to infrared ³H₄→³H₆ (~780 nm) transitions observed in the spectra. These transitions, although with low intensity, means that different Tm³⁺-related emitting centers coexist in the same sample suggesting that the ions must be placed in different site of symmetry. (Fig. 1; left and center). The chromaticity diagram (Fig. 1;right) exhibit emission color tuning of of MWO₄:Tm³⁺ (M= Ba, Sr) materials phosphors by changing the dopant concentration from 0.2 to 1.0 mol-%. These results suggest that the material can be used as an alternative to blue marker.

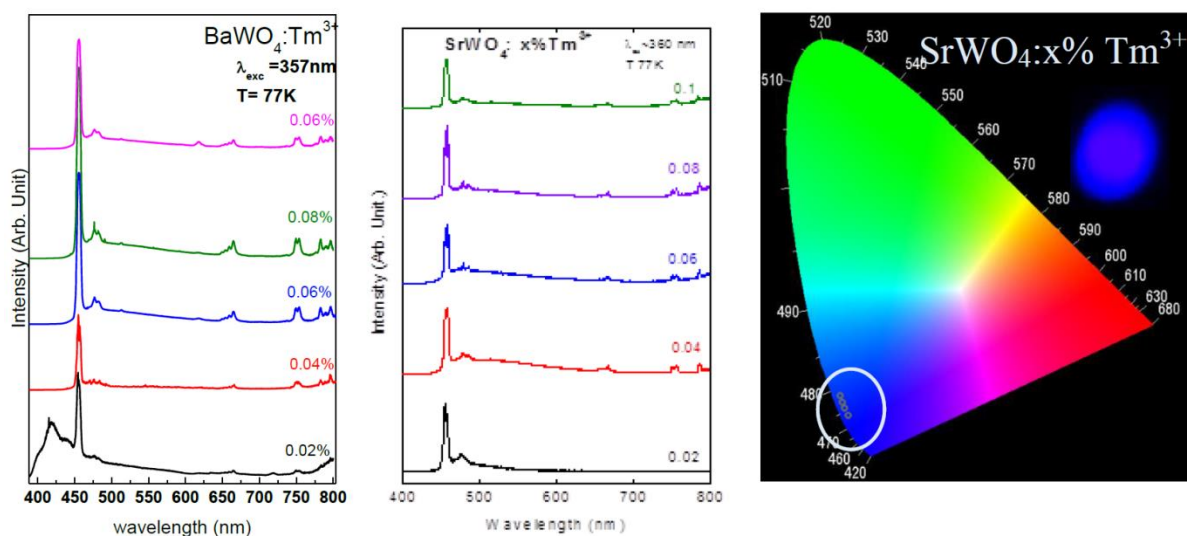


Figure 1. Emission spectra; (left and center) and CIE color coordinates; (right) of the MWO₄:Tm³⁺ phosphors.

[1] Kodaira, C. A.; Brito, H. F.; Malta O. L.; Serra, O. A. J. Lumin. 2003, 101, 11–21.