White light emission of the single-phase $CaWO_4:Dy^{3+}$ phosphors by simple synthesis and fast heating

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Tungstates activated by trivalent rare earth ions (R^{3+}) can be used for many optical devices [1]. Nowadays, there is an increasing interest in white phosphors emitting to application in white-light-emitting devices (WLEDs) replacing the conventional fluorescent lamps due its ecofriendliness and tuneable colours. Here we report preparation as well as the spectroscopic properties of the single phase new highly luminescent white emitting of Dy^{3+} doped into the $CaWO_4$ materials. The materials were prepared by coprecipitation method at room temperature with stoichiometry aqueous solutions of Na_2WO_4, $CaCl_2$ and $DyCl_3$ (0.1 to 5.0 mol% of the Ca^{2+} amount). The as-prepared materials were heated for 22 min between 900 – 1000 W in a domestic microwave oven and using Fe_3O_4 (60 g) susceptor as heating source. The XPD measurements revealed the $CaWO_4:Dy^{3+}$ particles belong to the tetragonal scheelite phase with $I4_1/a$ (#88) space group.

The emission arising mainly from the $^4F_{9/2} \rightarrow {}^6H_{15/2}$ (blue) and $^6H_{13/2}$ (yellow) transitions are corresponding to the 488 and 575 nm, respectively (Fig.). At lower doping concentrations the broad band (~420 nm) is due to the WO_4 group emission. Increasing the RE^{3+} doping concentration the main emission lines transitions of the Dy^{3+} are enhanced. After heating, the 1.0 mol% Dy^{3+} doped material exhibit a better whitish emission due to the simultaneous presence of broad band of the host in blue region and emission lines at longer wavelengths (Fig.). The lifetimes decrease monotonously in function of the Dy^{3+} concentration which indicates that the energy transfer from host to the Dy^{3+} becomes more efficient.

These results suggest that $CaWO_4:Dy^{3+}$ could act as a white emitting phosphor in solid state-lighting technology.

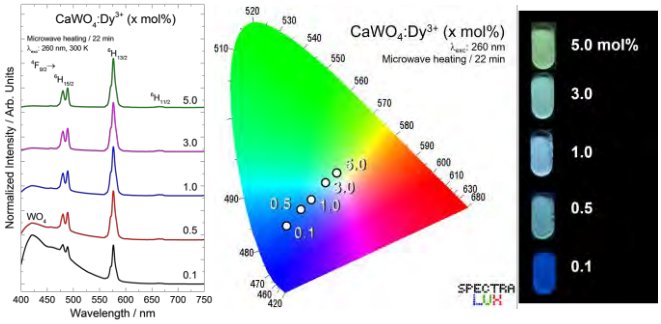

Fig. Emission spectra (left), CIE color coordinates (middle) and digital camera photos (right) of the $CaWO_4:Dy^{3+}$ (0.1–5.0 mol%) phosphors under excitation at 260 nm heated in microwave oven.

Keywords: tungstate, white emission, dysprosium, luminescence.

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References

[1] Barbosa, H. P.; Kai, J.; Silva, I. G. N.; Rodrigues, L. C. V.; Felinto, M. C. F. C.; Hölsä, J.; Malta, O. L.; Brito, H. F.; J. Lumin. (2016) 170, 736.