

White light emission of the single-phased $\text{CaWO}_4\text{:Tb}^{3+},\text{Eu}^{3+},\text{Dy}^{3+}$ materials prepared by an environmentally friendly method

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Trivalent rare earth (RE^{3+}) doped tungstates $[\text{WO}_4]^{2-}$ host matrix offers possibility to design new photoluminescent materials.¹ Nowadays, there is an increasing interest of WLEDs to replace the conventional fluorescent lamps due its environment-friendliness and tuneable colours.^{2,3} Here we report preparation as well as the spectroscopic properties of the new highly luminescent white emitting materials $\text{Tb}^{3+}/\text{Eu}^{3+}/\text{Dy}^{3+}$ triply-doped in CaWO_4 matrix. The materials were prepared by coprecipitation method at room temperature with stoichiometry aqueous solutions of Na_2WO_4 , CaCl_2 and RECl_3 (RE^{3+} : Tb, Eu, Dy with 0.5 to 5.0 mol% of the Ca^{2+} amount). The RE^{3+} doping concentrations were identical for each rare earth ion in the range from 0.5-5.0 mol%. The XPD measurements revealed the as-prepared $\text{CaWO}_4\text{:xTb}^{3+},\text{xEu}^{3+},\text{xDy}^{3+}$ (x: 0.5-5.0 mol%) particles

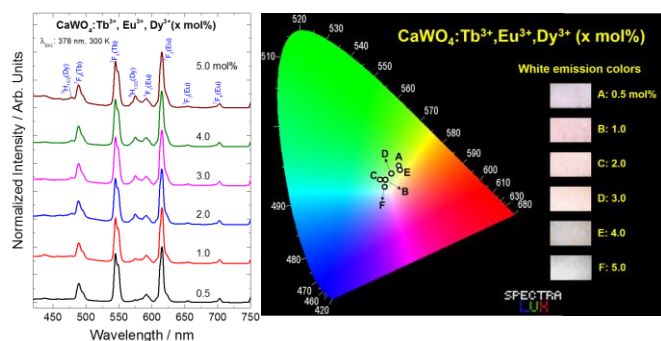


Fig. 1. Left) Emission spectra; right) CIE color coordinates of the $\text{CaWO}_4\text{:Tb}^{3+},\text{Eu}^{3+},\text{Dy}^{3+}$ (0.5–5.0 mol%) phosphors under excitation @378 nm.

belong to the tetragonal scheelite phase with $I4_1/a$ (#88) space group. The average crystallite sizes are ~ 11 nm.

The white luminescence emission arising mainly from the $^5\text{D}_0 \rightarrow ^7\text{F}_2$ (Eu^{3+}), $^5\text{D}_4 \rightarrow ^7\text{F}_5$ (Tb^{3+}) and $^4\text{F}_{9/2} \rightarrow ^6\text{H}_{15/2}$ (Dy^{3+}) transitions at 614 nm (red), 545 (green) and 488 (blue), respectively (Fig. 1). The emission lifetimes of the $^5\text{D}_0$, $^5\text{D}_4$ and $^4\text{F}_{9/2}$ emitting levels were and their values are reduced when comparing the ratio from 0.5-5.0 mol% of the RE^{3+} ions, respectively. The results indicate the

presence of energy transfer processes between RE^{3+} . These values could be assigned to non-radiative energy transfer contributions of the $\text{Dy}^{3+} \rightarrow \text{Tb}^{3+}$, $\text{Dy}^{3+} \rightarrow \text{Eu}^{3+}$ and $\text{Tb}^{3+} \rightarrow \text{Eu}^{3+}$ systems due the cross relaxation. The CIE diagram (Fig. 1 right) exhibits emissions whitish colour indicating that these materials could be suitable for solid state lighting technology.

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