

**XVIIth International Krutyń Summer School
2015**

**Krutyń, Masurian Lake District, Poland,
June 14-20, 2015**

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Red Persistent Luminescence in $\text{CaWO}_4:\text{Eu}^{3+}$ Phosphors

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Strong luminescence from the trivalent rare earth (R^{3+}) doped tungstate $[\text{WO}_4]^{2-}$ hosts offers possibility to design new luminescent materials [1]. Persistent luminescent materials that emit in red are still rare [2]. This work reports the investigation of the $\text{CaWO}_4:\text{Eu}^{3+}$ materials which show persistent luminescence and were prepared with a low cost and easy synthesis route. The materials were obtained by mixing stoichiometric amounts of aqueous solutions of Na_2WO_4 , CaCl_2 and EuCl_3 (Eu^{3+} as 0.1 to 10 mol-% of the Ca^{2+} amount). The as-prepared materials were annealed in static air at 1000 °C for 3 hours. The XPD patterns revealed the pure tetragonal scheelite phase with $I4_1/a$ (#88) as the space group. The X-ray Absorption Near Edge Structure (XANES) spectra at the Eu L_{III} edge of $\text{CaWO}_4:\text{Eu}^{3+}$ show only the Eu^{3+} but no Eu^{2+} species. The emission spectra are dominated by the high intensity $^5\text{D}_0 \rightarrow ^7\text{F}_2$ hypersensitive transition, indicating the non-centrosymmetric environment of Eu (Fig.; left). The C.I.E. chromaticity diagram (Fig.; center) suggests emission color tuning from blue to red just by changing the Eu^{3+} concentration from 0.1 to 10.0 mol-%. Despite different conventional emission color of the materials (Fig.; right), persistent luminescence is always red. In phosphors doped with 0.1 and 1.0 mol-% of Eu^{3+} , persistent luminescence is longer than with 10 mol-% doping, indicating concentration quenching. These results suggest that these materials may be used as alternative red persistent luminescence markers though optimizing the phosphor properties is required.

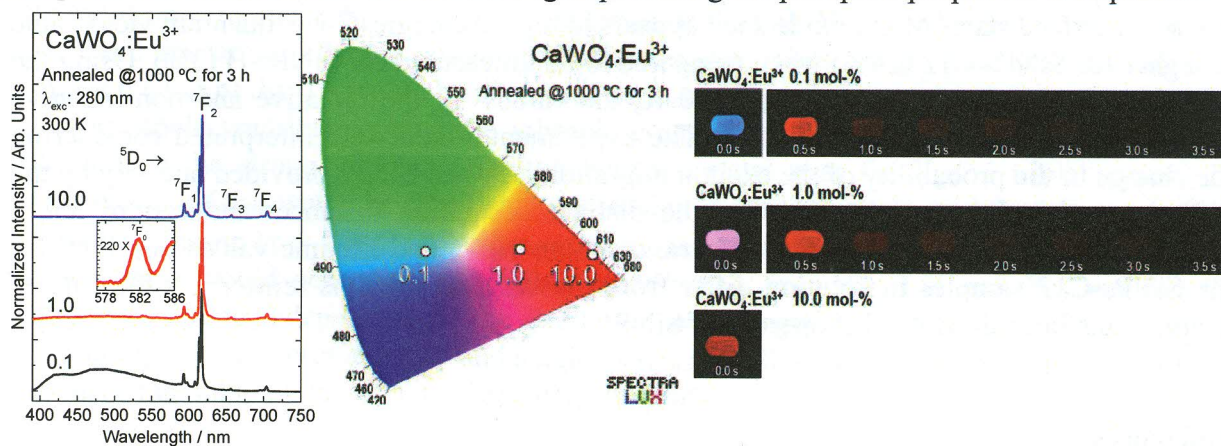


Fig. Emission spectra, C.I.E. color coordinates and photographs taken each 0.5 s after ceasing the excitation of the $\text{CaWO}_4:\text{Eu}^{3+}$ (x_{Eu} : 0.1; 1.0 and 10 mol-%) phosphors.

References

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- (2) Brito, H.F.; Hölsä, J.; Laamanen, T.; Lastusaari, M.; Malkamäki, M.; Rodrigues, L.C.V. *Opt. Mater. Express* **2012**, 2, 371.