Non-aqueous sol-gel synthesis of $CaAl_2O_4$: Eu

Nursen Avci*, Philippe Smet and Dirk Poelman

LumiLab, Department of Solid State Sciences, Ghent University, Krijgslaan 281-S1, B-9000 Gent/Belgium (*email: nursen.avci@ugent.be)

Alkaline earth aluminates MAl_2O_4 (M= Ca, Sr and Ba) are well-known materials due to their mechanical strength, high resistance to chemical attack, and excellent dielectric properties. In addition to these superior properties, alkaline earth aluminates doped with divalent europium show bright violet ($CaAl_2O_4$) to green ($SrAl_2O_4$) afterglow luminescence [1]. Rare earth co-doped alkaline earth aluminates combining long decay time with high initial brightness are amongst the best persistent luminescent materials [2]. To prepare them different kinds of techniques have been used such as solid state reaction, co-precipitation, microwave, Pechini, combustion and sol-gel. In these methods, sol-gel puts forwards some benefits namely relatively low preparation temperature, control of the stoichiometry with simple equipment and high homogeneity.

In this work we summarize the preparation and optical properties of $CaAl_2O_4$: Eu. $CaAl_2O_4$ with different Eu concentrations (from 0% to 3%) was prepared via non-aqueous sol-gel technique using calcium nitrate tetrahydrate ($Ca(NO_3)_2.4H_2O$), aluminium sec-butoxide $Al[O(CH_3)CHC_2H_5]_3$), butanol (n-BuOH), acetylacetone (AcAcH) and hydrated europium nitrate. After the preparation, samples were annealed at different temperatures (from 800 to 1200°C) for 1 h in air to obtain monoclinic calcium aluminates. Subsequently to reduce Eu^{3+} to Eu^{2+} different methods were used like annealing under H_2/N_2 atmosphere.

In previous investigations it was suggested the strongest luminescence in this material is obtained for the monoclinic phase. The minimum reported temperature to obtain monoclinic $CaAl_2O_4$ is around 1200°C. The X–ray diffraction (XRD) spectra of undoped and doped samples reveal that the formation of monoclinic phase begins at 900°C and extra phases start to form at 1100°C (fig1).

Photoluminescence measurements show that the optimum temperature is 1000°C. The influence of the doping concentration and the persistent luminescence properties of $CaAl_2O_4$: Eu will be reported.

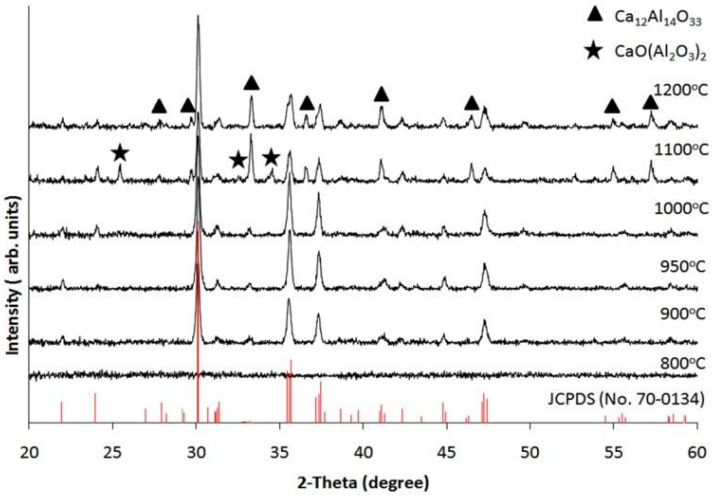

Fig1. XRD spectra of undoped $CaAl_2O_4$ annealed at various temperatures.

1. J. Sanchez-Benıtez, A. de Andres, M. Marchal, E. Cordoncillo, M. Vallet Regi and P. Escribano, *J. Solid State Chem.* **171**, 273 (2003).
2. K. Van den Eeckhout, P. F. Smet, D. Poelman, Materials **3**, 2536 (2010)

- **T2**
- **Oral presentation**