

Red Mn-Phosphors - Crystal Chemistry and Derived Mixed-Layer Structures in the System CaO-Al₂O₃-MgO-MnO_x

Vogl, Kathrin¹ Göbbels, Matthias¹ Zollfrank, Cord²

¹FAU Erlangen-Nürnberg, GeoZentrum Nordbayern, Mineralogie, Schlossgarten 5a, 91054 Erlangen, Germany ²FAU Erlangen-Nürnberg, Lehrstuhl für Werkstoffwissenschaften (Glas und Keramik), Martensstr. 5, 91058 Erlangen, Germany

The improvement and development of red phosphors for fluorescent lamps is one of the important research fields in materials science. Recently the luminescence properties of red phosphors with a nominal composition referring to the formula for the Ca-hexa-aluminate CaAl₁₂O₁₉:Mn⁴⁺ were reported by Murata et al. 2005 and Park et al. 2007. They found a strong dependence of the luminescent intensity by doping with Mg and Mn. In addition the presence of fluxes like CaF₂ and MgF₂ seem to increase the reactivity and subsequently also the luminescent intensity. Crystal chemical, structural and phase related aspects have not been studied.

In the group of hexa-aluminates compounds exhibiting magnetoplumbite- and beta-alumina structures are stable. A wide crystal chemical variety gives rise to numerous properties with large potential for chemical fine tuning. The crystal structures present can be explained as mixed layer structures (Göbbels 2004).

Among the hexa-aluminates the most well known and important compounds are the blue phosphor BAM BaMgAl₁₀O₁₇:Eu²⁺ (Göbbels, et al. 2002) and the green phosphor BaMgAl₁₀O₁₇:Eu²⁺, Mn²⁺ both exhibiting the beta-alumina crystal structure. The close related but slightly different structure of magnetoplumbite is found in the case of CaAl₁₂O₁₉. It was sort of surprising finding in this magnetoplumbite compound such strong luminescence.

Comparing this reported compound with the already known phase relations in the system CaO-Al₂O₃-MgO (Göbbels, et al. 1995) the question arises if the "higher" hexa-aluminates reported (Iyi et al. 1995) could also be found in the system CaO-Al₂O₃-MgO-MnO.

In this presentation the existence of the compounds Ca₂(Mg,Mn)₂Al₂₈O₄₆ and Ca(Mg,Mn)₂Al₁₆O₂₇ and more detailed phase relations and crystal chemical correlations will be presented.

References:

Göbbels M. (2004), Crystal chemistry and crystal structures of complex hexa-aluminates and hexa-ferrites, Applied Mineralogy in Research, Economy, Technology, Ecology and Culture. Proc. ICAM 2004, 61

Göbbels M., Dauscher M. & Jüstel Th. (2002), Ba-beta-alumina phosphors: crystal chemistry and stability, E-MRS Spring Meeting 2002 (E-MRS Spring Meeting Strasbourg). L 5

Göbbels M., Jung J. & Woermann E. (1995), The Al-rich part of the system CaO-Al₂O₃-MgO, Part I.: Phase relationships, J.Solid State Chem., 120, 358-363

Iyi N., Göbbels M. & Matsui Y. (1995), The Al-rich part of the system CaO-Al₂O₃-MgO, Part II.: Structure refinement of two new magnetoplumbite related phases, J.Solid State Chem., 120, 364-371

Murata T., Tanoue T., Iwasaki M., Morinaga K. & Hase T. (2005), Fluorescence properties of Mn⁴⁺ in CaAl₁₂O₁₉ compounds as red-emitting phosphor for white LED, Journal of Luminescence, 114 (3-4), 207-212

Park W.J., Lee S., Jung M.K., Moon J.W., Im S.J., Masaki T. & Yoon D.H. (2007), Luminescence properties CaAl₁₂O₁₉:Mn⁴⁺ with flux by liquid phase precursor synthesis, E-MRS Spring Meeting 2007 (E-MRS Spring Meeting Strasbourg), C/PI-16

→

Abs. No. **198**
Meeting: **DMG 2008**
submitted by: **Vogl, Kathrin**
email: **kathrin.vogl@gmx.de**
date: **2008-05-29**
Req. presentation: **Poster**
Req. session: **S16**