Study of luminescent center in new blue PDP phosphors $CaMgSi_2O_6$:Eu by XAFS

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Recently, Plasma Display Panels (PDPs) have been widely used as a large flat panel display. However PDPs have a serious problem showing the luminance degradation of blue phosphor $BaMgAl_{10}O_{17}:Eu^{2+}$ due to the valence change of Eu during panel production and panel operation. So, we proposed a new blue phosphor $CaMgSi_2O_6$:Eu (CMS) and found that the phosphor reveals good resistance for thermal treatment, vacuum ultraviolet irradiation, and Xe-sputtering. However, luminance of CMS has not been sufficient to use for practical PDPs. In this study, we have measured XAFS of CMS synthesized by various conditions and checked the valence of Eu to find the optimum synthesis condition to obtain the efficient CMS phosphor.

We measured Eu-L_3 edge XAFS of CMS. The absorption spectra of the CMS with the Eu concentration below and above 2 mol% were obtained by fluorescence mode using Lytle detector and by transmission mode, respectively. We measured Eu-K edge and Ca-K edge XAFS to clarify the occupancy site of Eu in CMS phosphor.

Figure 1 shows the variation of Eu-L_3 absorption spectra. Both Eu^{2+} and Eu^{3+} absorption peaks can be found in each spectrum with various Eu concentrations. At 1 mol% Eu in the starting material, the Eu^{2+} content in the powder reaches at maximum. Above 2mol%, Eu^{3+} content increases with increasing Eu concentration. These results imply that ratio of starting materials in the source mixture and the concentration of reducing gas in the furnace differ from the optimum condition to obtain Eu^{2+}-doped single phase CMS phosphor. In addition, the results suggest that the optimum Eu concentration will be found around 1mol%.

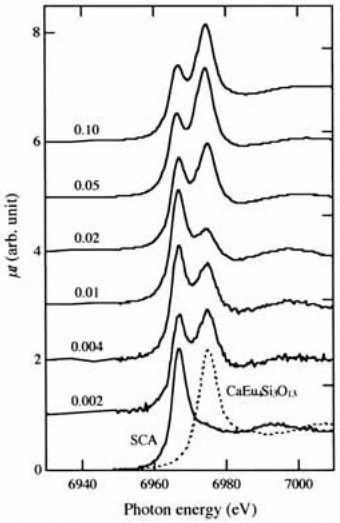

Fig. 1. Variation of Eu-L_3 XANES spectra of CMS with different Eu concentrations. SCA and $CaEu_2Si_3O_{13}$ are standard of Eu^{2+} and Eu^{3+}, respectively.

Investigation of local structure and synthesis mechanism of titanate nanotube by XAFS

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1. INTRODUCTION:

Since carbon nanotube has been discovered by Iijima, much attention to the synthesis of various nanotubes is paied in nanotechnology. Especially, titania based nanotubes are one of most promising nanotubes for various applications as photocatalysts, sensors, and high efficient solar cells. After titania or titanate nanotubes synthesized by hydrothermal treatment of TiO_2 in NaOH solution are recently reported, the real structure of titania or titanate nanotubes and the synthesis mechanism have been studied by many researchers. However, the fine structural nature for these nanotubes is not well revealed. Therefore, in the present study, we fabricared titanate nanotubes synthesized by hydrothermal treatment of TiO_2 in NaOH solution and evaluated the local structures of Ti-K edge by XAFS measurement at BL01B1. The information of local structure of Ti-K edge led to the understanding of local structure around Ti during the synthesis process of nanotubes.

2. EXPERIMENTS:

In this paper, the synthesis of nanotubular titania has been carried out through a soft chemical hydrothermal reaction of various TiO_2 powders in a NaOH aqueous solution system at 383 K. The nanotubular products prepared in this studies were evaluated by XRD and TEM. EXAFS modulations were analyzed by using standard methods. The continuous absorption background was continuous absorption background was estimated by fitting the spectrum before the edge by a Victoreen function, while the main absorption beyond the edge was fitted with an iterative procedure. Structural information was extracted by single-scattering theory using software made by the Rigaku software (REX2000).

3. RESULTS:

XRD results suggested that these nanotubes are identified to be tetratitanate $H_2Ti_4O_9 \cdot H_2O$. The morphology and yield of titanate nanotubes were found to be strongly dependent on the reaction time of the hydrothermal process. XANES of Ti-K edge EXAFS spectra are shown in Figure 1. These titanate nanotubes possessed 6 of coordination and its intensity increased with hydrothermal time. Therefore, it is thought that these titanate nanotubes were composed of TiO_6.

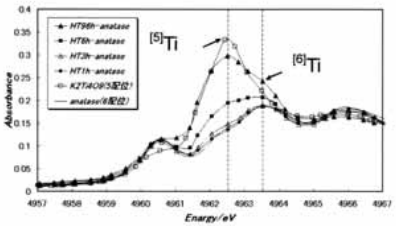

Fig.1. XANES of Ti-K edge for titanate nanotubes.