2004B0907-RI-np-TU BL19B2

XAFS analysis of light-emitting center ion Eu in oxide phosphors

Satoshi Okumoto*[1] (15009), Shinjiro Noma[1] (5258), Tomoyuki Nakajima[1] (15501), Takao Hayashi[2], Keiichi Yamazaki[2], Keishi Shibata[2], Naoko Doi[2], Tetsuo Honma[3] (2073)

1) Analytical Evaluation & Reliability Technology Center, Matsushita Electric Works, Ltd.
2) Advanced Technologies Fusion Laboratory, Matsushita Electric Works, Ltd.
3) Japan Synchrotron Radiation Research Institute / SPring-8

Oxide phosphors, which contain rare earth elements, are widely used in the display devices and the lighting equipments. These optical properties are related to the local structures around rare earth atoms, which are light-emitting center. It is important to reveal the relationship between the local structures around rare earth atoms and optical properties in order to produce more highly efficient phosphors.

Oxide phosphors, Y_2O_3:Eu:Bi, $BaLaAlO_4$:Eu and $SrLaAlO_4$:Eu were prepared at 1400～1600K under the air or the reducing atmosphere. XAFS measurements were performed at BL19B2 of SPring-8.

Figure 1 shows Fourier transform of k^3-weighted Eu K-edge EXAFS spectra. The three peaks at 2.32 Å, 3.53 Å and 4.02 Å correspond to the inter-atomic distance from Eu to the nearest, second and third near neighbor atoms of O, Y and both Y and O, respectively. This result shows that Eu atoms can almost completely substitute Y atoms of the matrix to the extent of 10%Eu in Y_2O_3. The optical properties of co-doping system Y_2O_3:Eu:Bi changed drastically increasing with the concentration of Bi from 0% to 5%. On the contrary, the local structures around Eu atoms weren't observed remarkable changes.

We also carried out Bi L_{III}-edge XAFS measurements. From the results of XAFS analysis, it was found that Bi atoms hardly substitute Y atoms. As one reason, there is a possibility that the ion radius of Bi is larger than that of Y and Eu.

The Eu L_{III}-edge XANES spectra of $BaLaAlO_4$:Eu and $SrLaAlO_4$:Eu are shown in Figure 2 with their reference samples. These XANES spectra exhibit that Eu in $BaLaAlO_4$ exist only as the trivalent valence. On the other hand, Eu in $SrLaAlO_4$ exist as the mixed valence of divalent and trivalent.

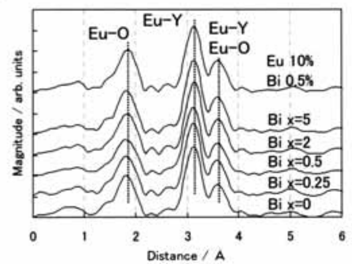

Figure 1 Fourier transform of k^3-weighted Eu K-edge EXAFS spectra of Y_2O_3:Eu(5%):Bi(x%) and Y_2O_3:Eu(10%):Bi(0.5%)

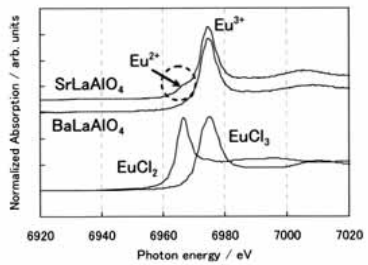

Figure 2 Eu L_{III}-edge XANES spectra of $BaLaAlO_4$ and $SrLaAlO_4$ and their standards that contain Eu(II) or Eu(III)

2004B0911-RI-np BL19B2

In-situ observation of the generated water in a fuel cell

T. Mukaide (6546)[1], S. Mogi (15629)[1], J. Yamamoto (15627)[1], H. Ito (14201)[1], K. Takada (7307)[1], T. Noma (7329)[1*], K. Kajiwara (1794)[2]

[1] *Leading-Edge Fusion Research Center, Canon INC.* [2] *SPring-8, JASRI*

Fuel cells attract considerable attention for their high power generating efficiency and extremely small harmful emissions. There are four major types of fuel cells, which are used in different ways according to their different characteristics. Polymer electrolyte fuel cells (PEFC) are suitable for a small size power source, because they have high power density and are capable of operating at room temperatures. One of the serious problems for PEFC is generated water management. If the excess water stays in the cell, it may block fuel supply. On the other hand, dry out of the proton-exchange membrane (PEM) reduces the power generation efficiency.

In this study, we attempted to observe the water in the PEFC directly by X-ray refraction enhanced imaging method. The experiment was performed at the third experimental hutch of BL19B2. The X-ray beam from the storage ring was tuned to 26keV by the Si(311) double-crystal monochromator and collimated into 5mm_5mm beam. The X-ray beam penetrated to the cell parallel to the plane of the PEM. The transmitted beam was detected by an image detector placed at a distance of 2.3m from the fuel cell. It consists of a CCD camera and a beam monitor. The X-ray refraction-contrast images of the PEFC were recorded at 8sec intervals during power generation.

X-ray refraction-contrast images of a fuel cell are shown in Fig. 1. The distribution of the water near the PEM is visible and water droplets at the upper wall are identified (Fig. 1(b)). It contrasts to the image of the cell before power generation (Fig. 1(a)).

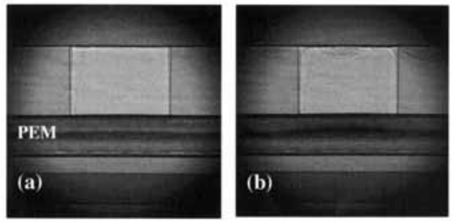

Fig.1
X-ray refraction-contrast images of the PEFC (a) before and (b) during power generation