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Structural analysis of the high-intensity fluorescence glass which three-dimensionally arranged a nano-crystals in glass

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Introduction

Fluorescent characteristic was influenced by the heat-treatment process for the crystallization in Eu ion doped silicon borate glasses. The local structure and the coordination number around Eu ions have not been well-defined in the crystallized glasses. In this experiment, XAFS analysis around Eu ions in the crystallized glasses has been performed.

Experimental

The Eu doped crystallized glasses were prepared from annealing at the temperatures of 500℃, 600℃, 650℃, 700℃ and 750℃. These samples were diluted by high-purity hexagonal BN powder. Eu L_{III}-edge XAFS spectra were measured with a Si(111) double crystals monochrometer at BL19B2. These spectra were measured by fluorescence mode using a Lytle type detector.

Results

Figure 1 shows the EXAFS oscillations obtained from the Eu L_{III}-edge EXAFS spectra of Eu doped crystallized glasses at 500℃, 700℃, and no crystallized one, respectively. As shown in the figure, the frequency of EXAFS oscillation are changed at around k = 6Å^{-1}, and become noisy in the range of k = 6Å^{-1} and more. Figure 2 shows Eu L_{III}-edge XANES spectra of the Eu doped crystallized glasses at 500℃, 700℃, and no crystallized one, respectively. A peak around 6981 eV and a small shoulder around 6972 eV are assigned to 2p → 5d transition in Eu^{3+} and Eu^{2+}, respectively. The intensity of shoulder around 6972 eV has decreased at the annealing temperature of 700℃. Detailed analysis on the Eu ion-doped crystallized glasses are in progress.

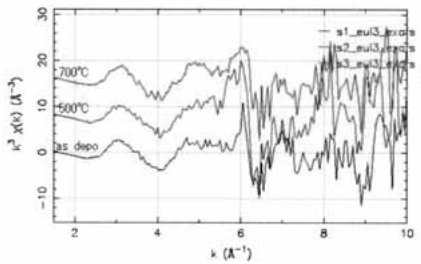

Fig. 1 EXAFS oscillations

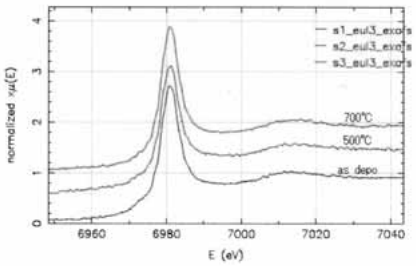

Fig. 2 Eu L_{III}-edge XANES spectra

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Chemical Bonding Analysis of Mg based Hydrogen Storage Materials with Additives by XAFS Measurement

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MgH_2 is one of the attractive hydrogen storage materials because it has high hydrogen capacity (~7.6 wt.%). However, the reaction velocity of hydrogen ab/desorption is too slow for practical use. In order to improve the reaction velocity, we have investigated the catalytic effect of transition metal oxides on hydrogen storage properties in MgH_2 prepared by mechanical milling. Transition metal oxides showed the good catalytic effects on hydrogen storage properties in MgH_2. However, the role of transition metal oxide catalysis on hydrogen storage properties has not been clarified yet. In this work, to directly clarify the mechanism of the metal oxide as catalyst, we analyzed the chemical bonding state of metal oxide in MgH_2 by XAFS measurements.

In the XANES profile, Nb K-edge for the 1mol% Nb_2O_5-catalyzed MgH_2 mechanically milled for 20h exists between that of Nb metal and Nb_2O_5 as shown in Fig.1. This suggests that the catalyst Nb_2O_5 was homogeneously dispersed on the surface of MgH_2, and then it might be reduced to metallic Nb during mechanical milling by MgH_2. Therefore, the metallic Nb dispersed in nanometer scale could act as an excellent catalyst for hydrogen desorption in MgH_2. In the case of V_2O_5 and TiO_2 as catalysts, we can also confirm from the XANES profiles (Fig. 1) that both are changed to the metallic V and Ti during mechanical milling, respectively. This work is the first observation for valence change in the metal oxide catalysts of hydrogen storage materials by the XAFS measurements.

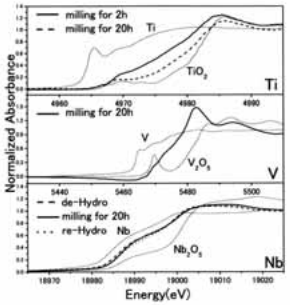

Fig.1 Nb,V and Ti K edge XANES profiles