Local Structure of Co and Eu Ions in $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ Thin Film

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X-ray absorption Near Edge Structures (XANES) spectroscopy and Extended X-ray Absorption Fine Structure (EXAFS) was used to investigate the valence states of Co and Eu ion and local structure of Eu ion in $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ thin film. ZnO (0001) thin films, typical thickness of 100nm growth on c-Al_2O_3, were doped with Co and Eu ion by using low energy implantation technique. The XANES measurements are sensitive to the electronic states and the structural symmetry of the sites of the absorbing atoms. Our investigation show that Eu ion is incorporated into ZnO lattices has mixed valence electronic states during ion implantation process. The mixed valence electronic states of Eu was disappear in annealing the film at 600 °C in an atmosphere of Ar. The heat treatment procedure does not have any effect on oxidation state of Co. The local structure of Eu is still in progress.The X-ray absorption measurements on the Co K-edge and Eu L_3 edge were carried out with synchrotron radiation at the 17C1 beam line

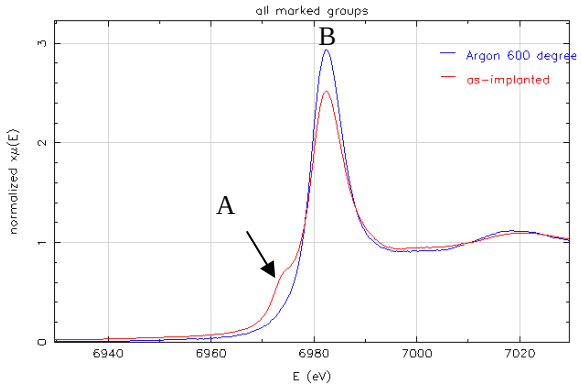

Fig. 1: The XANES spectra Eu L_3-edge for $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ as implantation and annealed at 600°C in Ar gas atmosphere

In Fig. 1, the Eu L_3-eged curve in the case of the as implantation $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ shows two features A and B. In case of the annealed $Zn_{0.92}Co_{0.04}Eu_{0.04}O$, feature B is seen but the feature A is disappeared. The energies for these two feature A and B are correspond to those EuO and Eu_2O_3 respectively.It may be concluded that as implanted films consist both of Eu^{2+} and Eu^{3+} but there is only Eu^{3+} precense in annealing film. The Radical distribution function (RDF) shown in Fig. 2 clearly indicateing the difference of local structure of $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ before and after annealing. The local structure details analysis is currently in process.

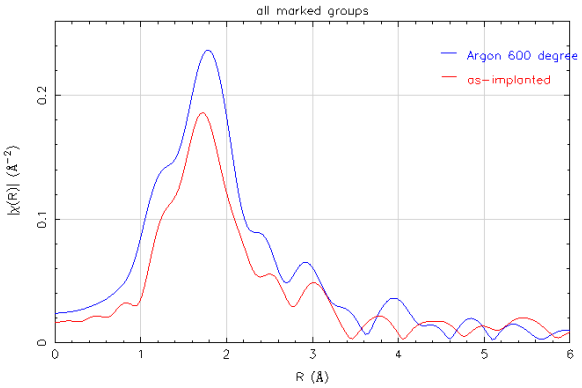

Fig. 2: Radical distribution function (RDF) for as implantation and annealing $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ thin film.

In Fig. 3, as-implanted $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ and annealing $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ has similar Co K-edge absorption of. The features are similar to Co K-edge for CoO. It can be said that both films show presence of Co^{2+} Studying detail structure of Co in $Zn_{0.92}Co_{0.04}Eu_{0.04}$ are difficult because post edge of Co-K absorption is overlap to Eu-L_3 absorbstion which is impossible by using standard procedure.

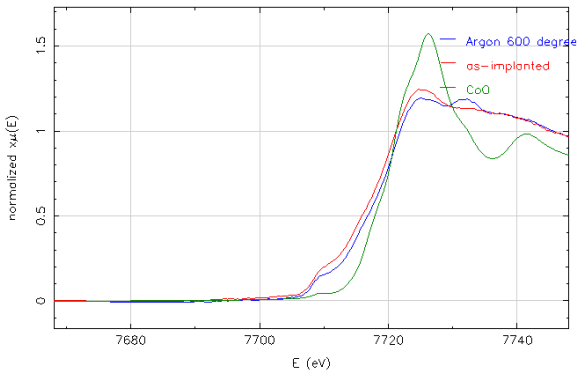

Fig. 3: The XANES spectra Co K-edge for $Zn_{0.92}Co_{0.04}Eu_{0.04}O$ as implantation, annealed at 600°C in Ar gas atmosphere and standard CoO