High energy X-ray imaging with a YAP(Ce) detector

Katsuya Hirota*(2204), Masayo Suzuki(260), Hidenori Toyokawa(386)

Japan Synchrotron Radiation Research Institute(JASRI)

A YAP(Ce) detector is currently under developement as a new generation of high energy X-ray imagers for 100 keV region. YAP(Ce) crystal has excellent scintillation characteristics, such as the fast decay time of 30 nsec, the high density of 7.4 g/cm^3, and the high light yield of 30% relative to that in a NaI(Tl) scintillator.

The detector is consists of 128 × 128 $YAlO_3$:Ce scintillators and 16 multi anode photomultipliers (Hamamatsu H6568). Each YAP(Ce) scintillator is 1 mm × 1 mm × 6 mm thick, and is coupled to wavelength-shifting fibers. The scintillation photons are read by a multi-anode photomultiplier located at the end of the fibers.

In the present study, we had a motivation to acquire the following two information ; 1) the performance of the YAP detector at 100 keV X-ray energy region, and 2) the general nature of the using prototype high speed data taking system we intend to introduce.

Fig.1 shows an observed diffraction pattern of Gd_2O_2S:Tb powder with 100 keV X-rays. The detector was positioned about 1.5 m downstream from the sample. Two arcs are clearly shown, and one or two arcs are weakly appearing in this figure as well.

The X-ray energy dependence of the position resolution was checked by using a Pb mask positioned in front of the detector. There was no appreciable change observed in the position resolution between 60 and 100 keV X-ray energy.

Next, we checked the new data taking system, which is to be used for the high counting rate experiments($\sim 10^6$ scattered X-rays). The maximum counting rate of this system was found for 145 kcps at the incident X-ray rate of 2.8 Mcps. It is encouraging to confirm that the detector sustained under this high counting rate, although the detecting efficiency remains relatively low. The reason of this low efficiency is caused by this data taking system. We planed to improve this performance to higher counting efficiency, upto 1 Mcps counting rate.

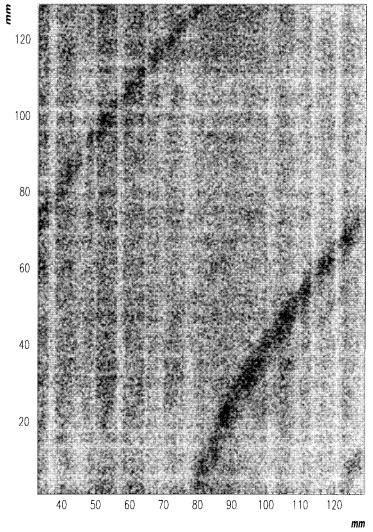

Fig.1 : diffraction pattern of Gd_2O_2S:Tb at 100 keV

XAFS studies of Local Structure about Mn atoms in Diluted Magnetic Semiconductors (Ga,Mn)N at low temperature

M. Sato[1](2072), H. Tanida[1](1275), T. Sasaki[2], Y. Yamamoto[2], S. Sonoda[3], S. Shimizu[3], H.Hori[2]

[1]JASRI, Mikazuki, Hyogo 679-5198, Japan

[2]JAIST, 1-1 Asahidai Tatsunokuchi, Ishikawa 923-1292, Japan

[3]ULVAC, Inc., 2500 Hagisono, Chigasaki, Kanagawa 253-8543, Japan

We succeeded the growth of a film of a GaN-based DMS doped with Mn ((Ga,Mn)N) exhibiting ferromagnetism with T_c much higher than 400 K.[1] In order to estimate the valence of Mn atoms, we measured the x-ray absorption near edge structure (XANES) of Mn K-edge of this (Ga,Mn)N film and investigate its chemical shift. At the same time, we measured the Mn K-edge of MnO (Mn II), Mn_2O_3 (Mn III), MnO_2 (Mn IV) and $KMnO_4$ (Mn VII) as the references. These measurements were carried out at BL19B2 by a fluorescence-yield mode using an array of 19 elements of Ga sold-state detectors because this sample was a thin film with a thickness of 360 nm.

In the figure are shown their XANES spectra. These spectra have three characteristic structures as shown by arrows; pre-edge peaks (1), shoulder peaks (2) and main peaks (3). As shown in this figure, these peak positions of the reference samples are shifted to high energy as the valence of Mn increases. This tendency can be seen clearly in the shift of main peaks. It can be regarded that these shifts reflect the chemical shit of Mn K-edge. The peak positions of (Ga,Mn)N are almost consistent with those of MnO. This fact suggests that the valence of Mn atoms in this (Ga,Mn)N film is almost II.

[1] S. Sonoda et al., to be published in J. Crst. Growth