

## **E546 : Measurement of Electronic X rays Correlated Pionic X rays**

The electron rearrangement after formation of pionic atoms has been studied by measuring the electronic X rays (eX rays) and pionic ones emitted from pionic atoms. This year, we pursue the analysis for the data taken in last year.

The eX-ray energy from pionic atoms is similar to the characteristic X-ray energy from  $Z-1$  atoms, because a negative pion strongly screens the nuclear charge  $Z$ , where  $Z$  is the atomic number of the target atom. This energy is influenced by the atomic state of the negative pion and the electronic structure. We define the difference of eX-ray energy between  $Z-1$  atom and pionic atom as “energy shift”. In this study, we have measured the energy shifts in various elements, ranging from zinc to lead. Figure 1 shows the atomic-number dependence of the energy shift. We found the difference in the energy shift values between  $K\alpha$ X rays and  $K\beta$ X rays in low  $Z$  region.

We have also examined the eX rays correlated with a pionic X ray for Mo, Sn and Ho metal and their metal oxide targets to reveal the electron rearrangement process after formation of pionic atoms in these targets. We found the differences in the fine structure of the KX rays (the ratio of  $K\alpha$  to  $K\beta$  X rays) between the metal and the oxide as shown in Fig. 2.

These observed phenomena suggest that pionic atoms are highly ionized by Auger process during the pionic cascade in the relatively low  $Z$  region. The eX-ray properties are similar to those for the atoms ionized by high-energy heavy ion collisions.

Figure caption 1

Atomic number dependence of the energy shifts.

Figure caption 1

Comparison between the fine structure of the KX rays for metal target and that for the oxide target.  $R$  means the ratio of  $K\alpha$  to  $K\beta$  X rays in pionic atoms normalized by that in one K-electron ionized atoms (induced by photoionization).

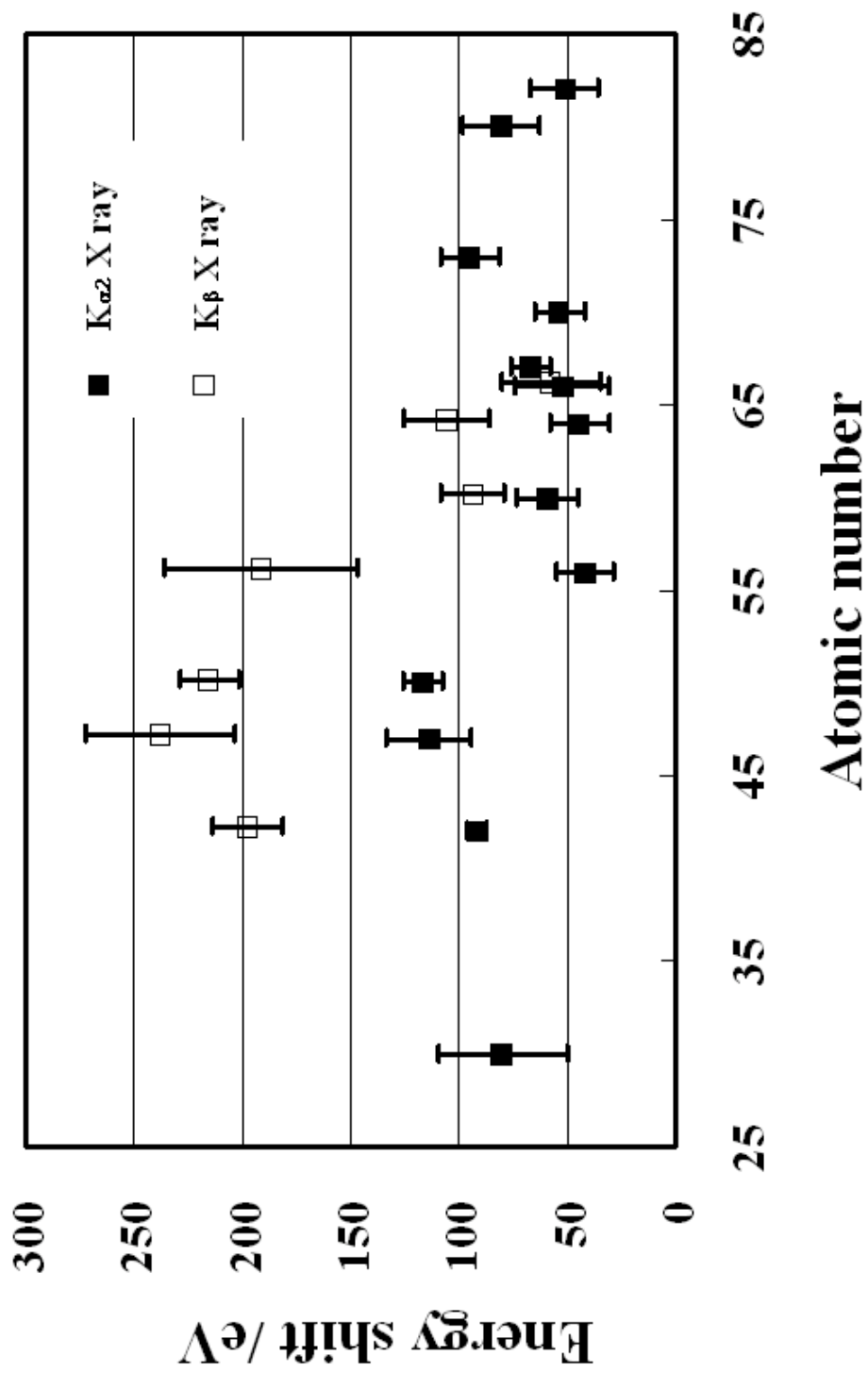


Figure 1

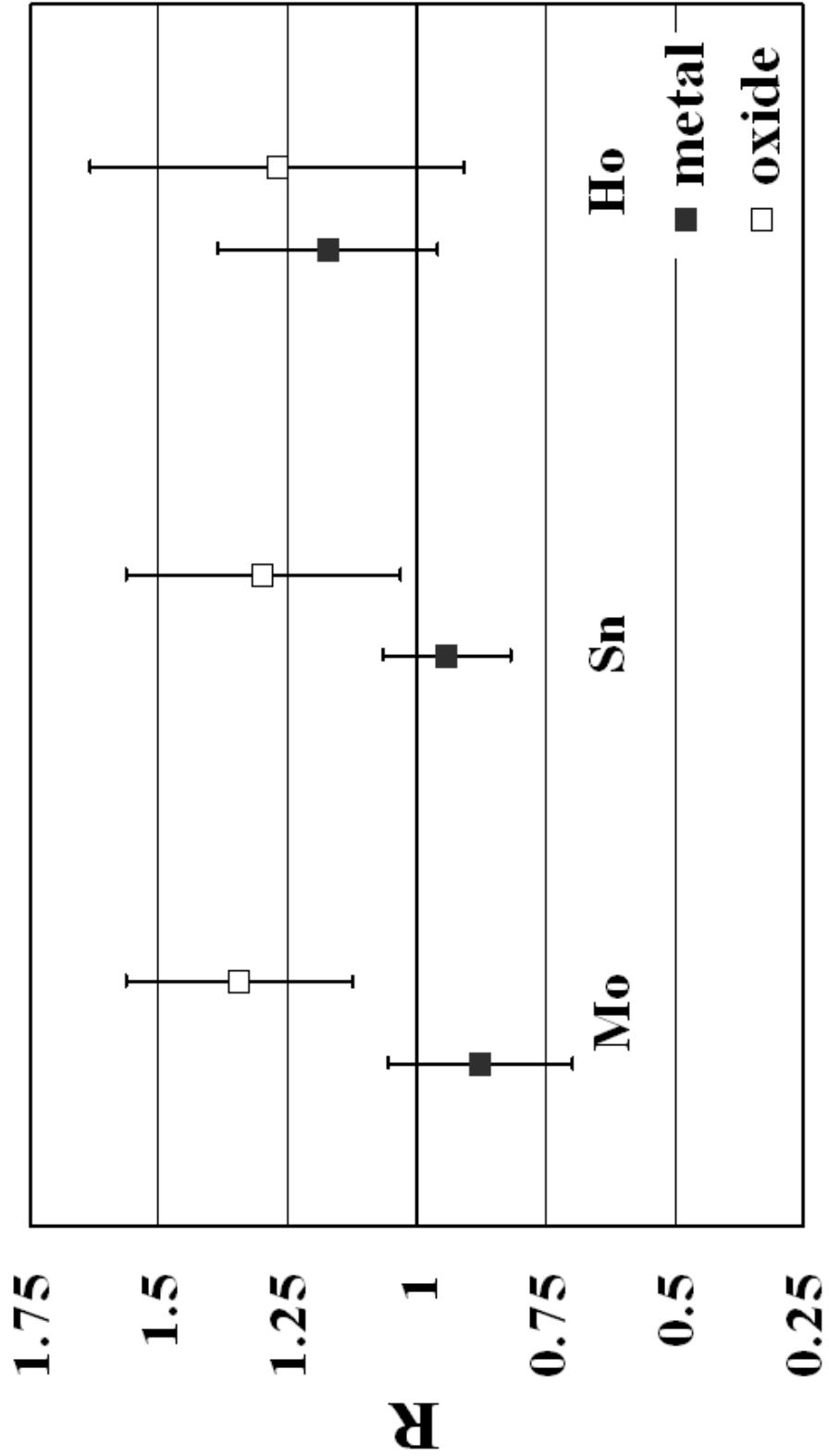


Figure 2