2002A0068-NS1-np BL27SU

Threshold Effects of Electron Emission in the Kr2p Ionization Region

Isao H. Suzuki (3220)*[a], Shin-ichi Nagaoka (3190)[b], Akiko Fujii (6930)[b], Toshio Ibuki (3217)[c], Shingo Samori (8423)[c], Kazumasa Okada (4215)[d], Yusuke Tamenori (1398)[e], and Haruhiko Ohashi (1102)[e]

[a] National Institute of Advanced Industrial Science and Technology, Tsukuba 305-8568, Japan
[b] Faculty of Science, Ehime University, Matsuyama 790-8577, Japan
[c] Kyoto University of Education, Fushimi-ku, Kyoto 612-8522, Japan
[d] Graduate School of Science, Hiroshima University, Higashi-Hiroshima 739-8526, Japan
[e] Japan Synchrotron Radiation Research Institute, Sayo-gun, Hyogo 679-5198, Japan

Radiationless transitions are of great interest because of the dominant mode for de-excitation of atomic inner-shell vancancies and of the main factor determining hole state lifetimes. Resonant Auger transitions related to shallow inner-hole states of rare gas atoms have been studied by a number of scientists. However measurements on Auger electron spectra of deep inner-hole states, e.g. Kr2p hole, have been limited owing to difficulty in realizing a high resolution study [1]. In the present study we have observed resonant and normal Auger electron spectra in the region of the Kr 2p ionization threshold as well as photoelectron spectra from the outer 3p orbital.

Measurements were performed using a high-resolution plane-grating monochromator installed in the c-branch of the soft X-ray Figure-8 undulator beamline, 27SU. The beamline provides linearly-polarized monochromatized synchrotron radiation with the horizontal and vertical directions in the photon energy region of 0.2 - 2.5 keV. Electron emission spectra were observed in the kinetic energy region of 1445-1480 eV using a high resolution energy analyzer, SES 2002.

Electron emission spectra observed at a nominal photon energy of 1681 eV are shown in Fig.1, where a thick curve (1st) indicates the spectrum observed at the direction parallel to the photon polarization and a thin curve (0.5th) does that at the perpendicular direction. At the curve observed at the parallel direction, the peaks for the $3p_{1/2}$ photoelectron, normal Auger electrons and the $3p_{3/2}$ photoelectron are seen in 1459 - 1467 eV, together with small peaks of resonant Auger electrons at higher energies. At the perpendicular one, normal Auger peaks and unidentified peaks are found at about 1463 eV and 1467 eV. The normal Auger peaks show tails into higher energies, being different from those observed at a photon energy of 1725 eV.

[1] S. Nagaoka et al., J.Phys. B33, L605(2000).

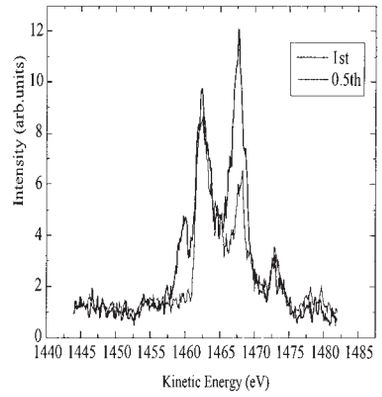

Fig.1: Electron emission spectra of Kr near the $2p_{3/2}$ threshold.

2002A0190-NS1-np BL27SU

Design and performance test of new supersonic clusterbeam source.

Y. Tamenori[1] (1308), K. Okada[2] (4215), K. Tabayashi[2] (7586), H. Hiraya[2] (3569), H. Tanaka[3] (5673), and H. Ohashi[1] (1102)

[1] SPring-8/JASRI, Mikazuki, Hyogo 679-5198, Japan
[2] Hiroshima University, Higashi-Hiroshima 739-8526, Japan
[3] Sophia University, Higashi-Hiroshima 739-8526, Japan

Free atomic and molecular clusters are interesting objects because they are intermediate states of matter between atoms and molecules from one side and solids from another side. Studies of the clusters as a function of their size give unique opportunities for the fundamental understanding of the relation between the properties of the isolated species and those of the condensed species.

In order to study electronic and geometric structure of clusters, the site-selectivity of soft-X ray should be a powerful tool. Because it is expected that the site-specific probe can distinguish the surface layer atoms and bulk atoms in the clusters. In this project, a new cluster source for spectroscopy of free cluster with synchrotron radiation has been constructed.

Figure 1 shows the schematic view of cluster experiment chamber. The chamber is divided into to rooms, expansion room (cluster source room) and main room (analysis room). The sample gas is expanded through a conical nozzle (10～100μm). The stagnation pressure of the nozzle is controlled in the range from 1 to 3 bar at room temperature. The resulting adiabatic expansion cools the gas, and cluster formation occurs. A wide-range turbo molecular pump (SHIMAZU, TMP2303LMC) with nominal pumping speed of 2000 L/s pumps the expansion room. The molecular beam including clusters is skimmerd by a 1 mm skimmer and enters the main room. In the main room, the molecular beam is crossed with soft X-ray beam in the ionization region and produced cluster ions are mass analysed by time-of-flight mass spectrometer. The size of the clusters is distributed around a mean value. The size distribution at the ionization region can be changed to adjust the stagnation pressure, nozzle diameter, the distance between nozzle and skimmer, and temperature. This setup will for instance allow production and studies of rare gas and small molecular clusters. We are planning the cluster experiment of various types (atoms, molecules, liquids, and metals) in the future. Therefore, the large space is secured in the expansion room so that improvement may be possible to the cluster source.

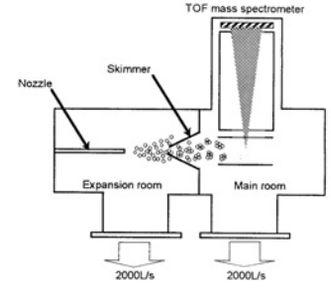

Figure 1 Schematic view of the cluster experiment chamber.