Threshold photoelectron photoion coincidence spectrum of Kr_3

Hiroshi YOSHII[*1], Tomohiro Aoto[2], Yumio MORIOKA[2], Kenji ITO[3] and Tatsuji HAYAISHI[1]
[1]Institute of Applied Physics, University of Tsukuba, Tsukuba city, Ibaraki 305 Japan
[2]Institute of Physics, University of Tsukuba, Tsukuba city, Ibaraki 305 Japan
[3]IMSS, High Energy Accelerator Research Organization, Oho, Tsukuba city, Ibaraki 305, Japan

Introduction

A study on the photoionization of rare gas dimers and their ions is important to understand the nature of the van der Waals interaction. In the past two decades, many theoretical and experimental studies on the homonuclear rare gas dimers have been performed. We have already observed the threshold photoelectron (TPE) spectrum of Kr gas and measured the vibrational structure of Kr_2^+[1]. After that, we also observed the threshold photoelectron photoion coincidence (TPEPICO) spectrum of Kr_2. The TPE spectrum of Kr_2 has a broad background around 910 Å, though the TPEPICO spectrum does not have.

Experiment

The experiments were performed on the beam line 20A. A 3-m normal incidence monochromator equipped with a 2400-lines/mm grating was used. Photon bandwidths of 0.06 Å could be obtained with 50-μm slit widths.

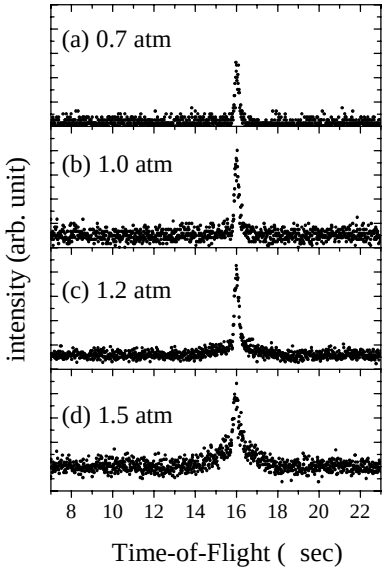

Fig. 1 TOF spectra of Kr

The experimental setup and technique were same as the experiment for heteronuclear rare gas dimers [2]. In brief, a threshold photoelectron was extracted by the penetrating field, and focused and discriminated by the chromatic aberration of two electrical lens systems. The Time-of-Flight (TOF) ion mass analyzer was used to distinguish Kr_2^+ from the other ions. The TOF spectra for several pressures were shown in Fig. 1. In the spectrum of higher pressure (d), the peak has a wide tail. It may be comes from the dissociation products of Kr_3^+. We observed TPEPICO spectrum in the gate of this peak and the tail.

Result

The observed spectra were shown in Fig. 2. The TPE spectrum (a) has a broad background, though the TPEPICO spectrum (b) of Kr_2 does not have the background. The TPEPICO spectrum in the gate of the tail of the TOF spectrum (c) has the broad peak around 910 Å. It seems that the origin of the broad peak is the dissociation product of Kr_3^+ that have a kinetic energy in the ionization region.

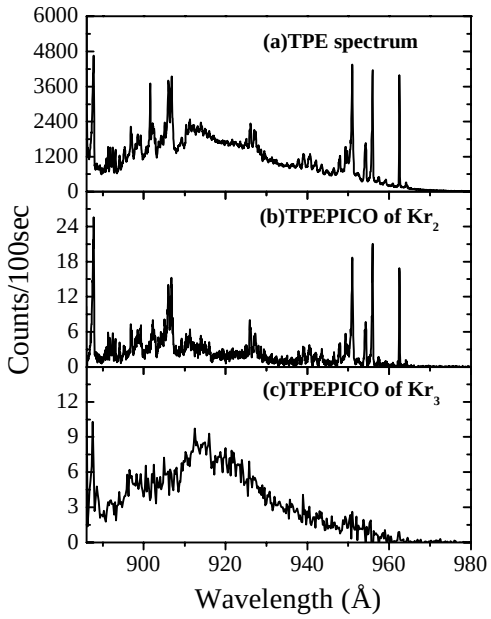

Fig.2 The observed TPE and TPEPICO spectra

The TPEPICO spectrum of Kr_3 was observed for the first time, and the origin of the broad peak in the TPE spectrum was assigned to Kr_3^+ dissociation products.

References

[1] Hall et al., J. Phys. B 28 2435 (1995)
[2] Yoshii et al., J. Chem. Phys. 111 10595 (1999)

*yoshii@bukko.bk.tsukuba.ac.jp