High Resolution Resonant Auger Electron Spectroscopy of Atoms and Molecules

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The soft X-ray photochemistry beamline has been designed for the study of soft X-ray interaction with matter, in particular inner-shell excitation and ionization of atoms and molecules and subsequent processes.

Main part of the experimental station has been installed in the experiment hall. At first a main chamber combined with a chamber for main pumping and that for differential pumping was evacuated down to about 3×10^{-7} Torr during 2 days. However the vacuum at the end of the reflectron-type time-of-flight mass spectrometer (RTOF) could not reach an order of 10^{-6} Torr. In order to improve the vacuum, a smaller turbomolecular pump was replaced with a larger one, which yielded a gas pressure of 1.5 $\times10^{-6}$ Torr. This finding suggests that the part of the RTOF is necessary to be baked out using a heater tape. A rotation mechanism of the main chamber for angular distribution measurements of fragment ions using the RTOF was tested under an order of 10^{-7} Torr, which showed that the vacuum did not deteriorate appreciably during the rotational motion.

For examining the performance of an electron energy analyzer of cylindrical mirror type (CMA; ESA-150-D), an electron gun, ELG-2, and an incident electron beam monitor were attached to the main chamber. First the electron gun was tested under the condition of 1.4×10^{-7} Torr, which indicated that the gun works steadily with providing an beam current of some μA. Typical oprerational factors are denoted in Table 1. A sample gas was introduced through a variable leak valve from the base plate connected to the rear flange of the chamber. The Ar gas pressure was maintained at about 3×10^{-6} Torr. The interface board for the operation on the CMA was inserted into a personal computer, Compaq, and an application software was installed at a disk-operating system of Window 95. A signal for elastic scattering was obtained on the display of a synchroscope, and the scanning voltage for the CMA operation was confirmed to work well. However, the data acquisition line in the interface board did not work, inducing no signal for electron detection in the computer. Further a signal collection was tried through the board using a test signal from a pulse generator instead of real electron signals. The computer system did not obtain these signals, being similar to the instance using real signals. Finally the company's people decided to get this board back and examine the board and the software in their workplace.

Table 1. An example of the electron gun operation.

Acceleration Voltage	700V
Focusing Voltage	310V
Grid 1 Voltage	0V
Grid 2 Voltage	100V
Deflector X Voltage	+11V
Deflector Y Voltage	-9V
Filament Voltage	1.15V
Filament Current	1.9A
Beam Monitor Current	0.3μA