Soft X-ray Photochemistry

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1. Outline of the Beamline

The soft X-ray photochemistry beamline is a public beamline designed for the study of soft X-ray interaction with matter and consequent atomic and molecular processes, both in the gas phase and on solid surfaces. With its high resolution monochromator, the beamline is capable of measurements of high resolution photoelectron and Auger electron spectroscopy, time-of-flight mass spectrometry, angular distribution of electrons and ions, angular correlation between them, and photoelectron-photoion coincidence measurements, primarily with effusively introduced gaseous samples .
The wavelength region to be covered was originally intended to be 0.2-2.0 keV with linear polarization, but it turns out that only photons above 0.5 keV will be available at the beginning.

2. Current Status

The design of the whole beamline, including deflecting and focusing optics, monochromator, end station, and differential pumping systems, was completed last year and the construction of the main parts, except for the monochromator, is under way. The optics and the end station, together with the differential pumping system, will be installed by the end of September, 1997, when the experimental researches using public beamlines start. Unfortunately, however, the installation of the monochromator will be delayed for some time: it is expected to be at the end of the 1997 fiscal year.

3. Details of the End Statioin

A schematic drawing of the experimental station is shown in Fig.1. It consists of three major parts: a chamber for differential pumping, which also serves as an optical filter chamber for order sorting, a main chamber to house all analyzers, and a chamber for main pumping. A reflectron-type time-of-flight mass spectrometer (RTOF) is attached to the main chamber. In the original design, an ion-energy analyzer with simultaneous mass analysis was also planned to be installed on the main chamber, but this has been discarded after intensive discussion in the subgroup duriing this year. The main chamber houses a photoelectron energy analyzer (PEEA), which is mounted on a device for rotating it around the photon beam axis in the vacuum. The main chamber together with all analyzers can also be rotated around the photon beam axis without deteriorating the ultrahigh vacuum of the system. These two independent rotation mechanisms allow the measurements of not only the angular distribution of photoelectrons and photoions but also the angular correlation between them. For this rotation, the main pumping system of the main chamber must be separated from it. The additional chamber for this pumping is connected to the main chamber via a rotation mechanism placed between them.

4. The First Experiments

The research subjects proposed for this beamline by the group members have been described in the preceding Annual Report[1]. These range from fundamental physics to complex chemistry, all requiring the high resolution and high photon flux intended with this beamline. However, the first research term commencing in October, 1 997 will mainly be devoted to the alignment of the optical and detection systems and fundamental measurements to establish the full performance. As the first research subject for

this period, we have proposed a high resolution resonance Auger electron spectroscopy of atoms and molecules . A11 active members of the subgroup will be involved in this subject.

Reference

[1] E. Ishiguro, A. Hiraya and I. Koyano, Spring-8 Annual Report 1 995, pp61-62 (1965)

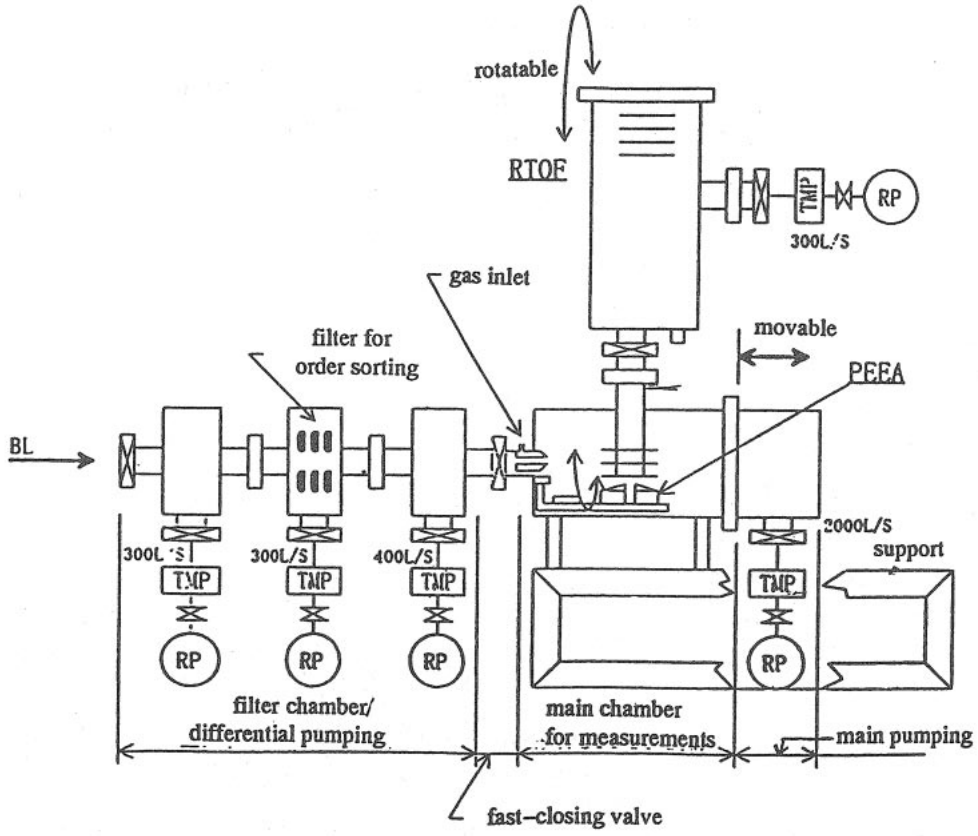

Fig.1. Schematic diagram of the experimental station