Equipment Development Center

VIII-L Development of "IMS Machines"

The technical staff of the Equipment Development Center is partly engaged in planning, researching, designing and constructing "IMS machines." This machine, crowned with the acronym of the Institute for Molecular Science, is a high-tech experimental instrument, with emphasis on new technical idea and co-operative work with members inside and outside the Institute including those in industries. We collect suggestions of new instruments once every year from all of the members of IMS.

In this fiscal year, 1998, three project themes (1 thorough 3) were adopted as IMS machines. IMS machine project 4 (IMS machine 1997) was completed, and project 5 (IMS machine 1997) is under way.

1. **Thin Shaped Cryostat for Opto-magnetic Measurement**
   (proposed by Shinji IZUMIDA and Takuhiko KONDOH)
2. **Vibration Method Magnetometer**
   (proposed by Yuko HOSOKOSHI, developed by Nobuo MIZUTANI and Yuko HOSOKOSHI)
3. **Preparation and Transfer System for Ice-embedding Sample**
   (proposed by Toshio HORIGOME and Shinji HASEGAWA, developed by Mitsukazu SUZUI and Kazuhiro KOBAYASHI)
4. **Surface Profiler of Mirrors for High-Resolution Monochromator**
   (proposed by Toyohiko KINOSHITA, developed with Hisashi YOSHIDA, Toshio HORIGOME, and Shuji ASAKA)
5. **Off-Axis Paraboloid Polarizing Mirror for Far-Infrared Light**
   (proposed and developed by Hideyuki OHTAKE and Takayuki YANO)

VIII-L-1 Surface Profiler of Mirrors for High-Resolution Monochromator

YOSHIDA, Hisashi; HORIGOME, Toshio; ASAKA, Shuji; KINOSHITA, Toyohiko

We are developing a measurement apparatus for a precise profiling of surfaces of optical elements which are necessary for constructing high-resolution monochromators in UVSOR facility. The outline of the present apparatus is shown in Figure 1. The light beam from the laser (L) incidents upon the sample under measurement (S), and the reflected light on the sample surface is detected by light detectors (D1 or D2). By measuring the direction of the reflected light, we can derive the surface shape of the sample.

We adopted glancing incidence geometry to ease measurement on plane, spherical and non-spherical mirrors with length of 10 cm to 1 m, which are often used in synchrotron radiation facility. In the present setup the position of the reflected light displaces in a relatively wide range during a measurement. To cope with this we used Y-Z translation stages with linear scales and 4-division photodiode detectors.

In order to determine the direction of the reflected light beam, we need to know the positions of arbitrary two pints on the beam. One position is measured by detector D2, and the other is measured by detector D1 by detecting the light that is partly reflected by the beam splitter (B).

The present optical system is very sensitive to mechanical vibration, temperature change and air flow. We fixed the whole components on an air-suspended vibration-free table and covered them with a plastic booth in order to stabilize the apparatus.

The outer view of the apparatus is shown in Figures 2 and 3.

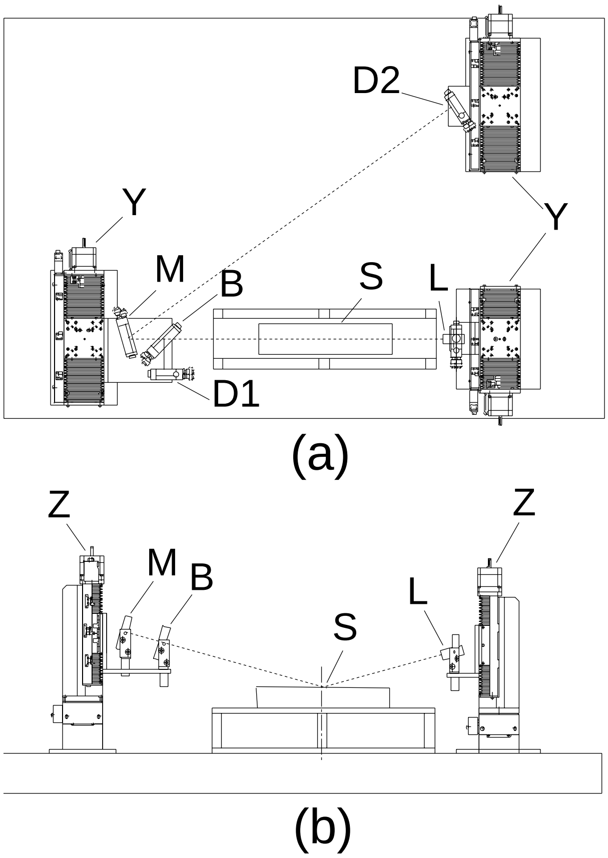

Figure 1. Design of the surface profiler. (a)Top view and (b)front view. L:Laser diode module, S:Sample mirror, B:Beam splitter, M:Mirror, D1 and D2:4-division photo diodes, Y and Z:Linear translation stages driven by stepping motors.

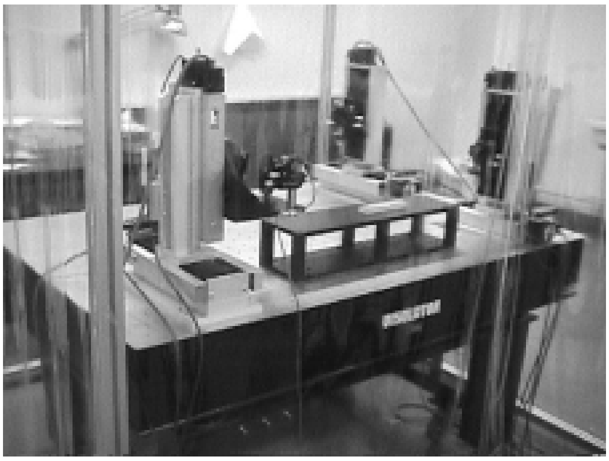

Figure 2. Surface profiler apparatus set up on a vibration-free table.

Figure 3. Driver for linear translation stage and host computer.

VIII-L-2 Preparation and Transfer System for Ice-Embedding Sample

HORIGOME, Toshio; HASEGAWA, Shinji; KOBAYASHI, Kazuhiro; SUZUI, Mitsukazu

Spectral measurement of ice-embedding bio-molecules under ultra high vacuum is promising for detailed understanding of their electronic structure. Few experiments, however, have been succeeded due to technical difficulty, except for electron microscopy. We have a project to develop the preparation and transfer system for ice-embedding sample that is applicable to various spectral techniques.

Figure 1 shows our contrivance to enable the photoemission measurement on ice-embedding bio-molecules. It is made up by three parts for sample preparation with liq. ethane, cryogenic transferring of sample to a measurement chamber, and fast evacuation with the aid of a special inner valve that separates between moderate and ultra high vacuum. Eighty percent of the whole system has been constructed. This system will be situated and work at UVSOR beamline after completion.

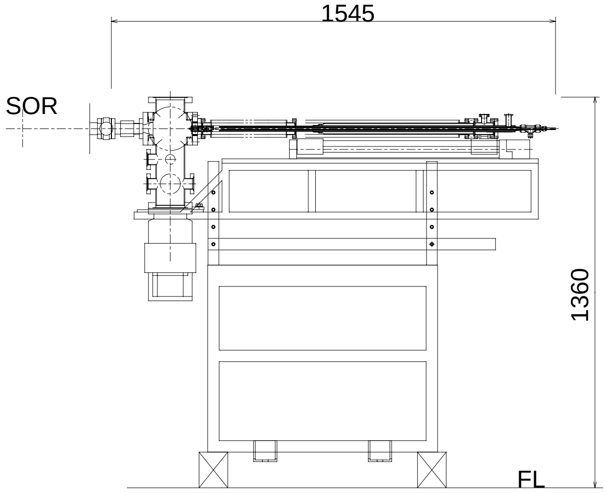

Figure 1. Preparation and transfer system for ice-embedding sample.

VIII-M Development of New Laser Materials

VIII-M-1 Amplification of Impurity-Associated Auger-Free Luminescence in Mixed Rubidium-Caesium Chloride Crystals under Core-Level Excitation with Undulator Radiation

MIKHAILIK, Vitalii B.[1]; ITOH, Minoru[2]; ASAKA, Shuji; BOKUMOTO, Yoshiho[2]; MURAKAMI, Junichi[2]; KAMADA, Masao
([1]Lviv Franko State Univ.; [2]Shinshu Univ.)

We obtained results of experimental studies aimed at testing the amplification of impurity-associated Auger-free luminescence (275 nm band) in mixed rubidium-caesium chloride crystals under core-level excitation with undulator radiation. The emission features observed under the best collimation of the optical cavity, namely the enhancement of the peak intensity, the sharpening of the emission spectrum and the shortening of the luminescence decay, suggest a possibility of the light amplification due to inverted population between the valence and 5pCs-impurity core states.