BL12XU
NSRRC ID

1. Introduction

The contract beamlines BL12 consist of an undulator BL12XU and a bending magnet BL12B2 beamlines. These beamlines were constructed and operated by the National Synchrotron Radiation Research Center (NSRRC), Taiwan. We report the activity of both XU and B2 during the fiscal year 2007.

2. Beamline operation

BL12XU has an undulator light source and it has two branches of a mainline and a sideline experimental hutches. The mainline has been fully operational since its opening in 2001, and mainly the inelastic X-ray scattering work is carried out at the facility. In the sideline, a new experimental station is presently being constructed for hard-X-ray photoemission spectroscopy.

3. Experiments in the mainline

3-1 High pressure experiments

The mainline is equipped with Kirkpatrick-Baez-type mirrors (KB mirrors) producing a beam spot of ~ 20μm × 20μm at the sample position, which is utilized for inelastic scattering and emission spectroscopy under high pressure. Pressure-induced transitions of the spin / electronic structure in iron compounds existing in the earth interior or a multiferroic material including manganese were observed. Furthermore, the dissociation of the water or CO_2, induced by an X-ray radiation in specific solid phases under high pressure was also studied.

3-2 High temperature experiments

Typical semiconductors and insulators such as boron, diamond and silicon have a melting point at high temperature of several thousand Kelvin. Compared with the solid states, their electronic structures in the liquid states are little investigated due to experimental difficulties and hence this field of study remains to be explored. An experiment recently performed in BL12XU to test the feasibility of inelastic X-ray scattering experiment at high temperature with a levitation (floating) furnace revealed a remarkable difference in the L-edge absorption spectra between the solid state and the liquid state of silicon. This successful result encourages us in a further study of the high temperature liquid with inelastic scattering.

3-3 Strongly correlated systems

It is still a major difficulty in modern condensed-matter physics to construct a model describing the electronic structures in strongly correlated electron systems. Experimental facilities are required to provide critical data for a modeling of such a system. For this goal, we measured inelastic scattering spectra or emission spectra on various correlated systems including 3d transition metals or 4f rare earth metals.

4. Commissioning of the sideline

A diamond 111 monochromator, introducing X-rays of 6～12keV to the experimental stations, was installed in an optics hutch in 2006. The platform, on which instruments will be placed, was

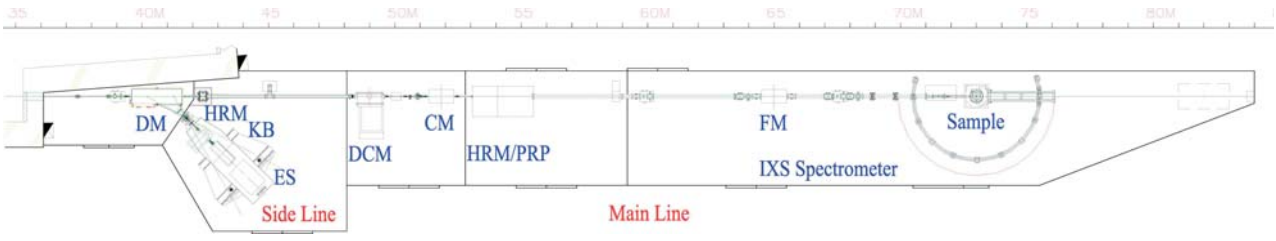

Fig.1 Schematic diagram (top view) of the BL12XU : DM is a diamond monochromator for the sideline, DCM a double crystal monochromator for the mainline, CM a collimating mirror, HRM a high resolution (channel cut) monochromator, PRP a phase retarding plate (to be installed), FM a focusing mirror, and IXS an inelastic x-ray scattering spectrometer.

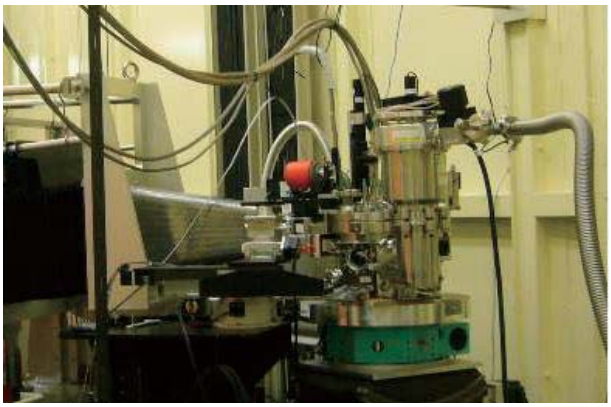

Fig.2 Levitation furnace mounted on the IXS spectrometer: A charged sample floats due to electric fields in the furnace and is heated up to several thousand Kelvin by lasers in three directions without a crucible.

also installed at the experimental station. At the beginning of 2007, the first beam was introduced to a sample position in the experimental station. Optical components such as mirrors and a high-resolution monochromator will be mounted soon, and a photoelectron analyzer will be placed afterwards.

N. Hiraoka, H. Ishii, C.-C. Chen, C.-Y. Huang, C.-Y. Liu and K.-D. Tsuei
NSRRC, Taiwan