BL practice at BL25SU

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Program of BL practice

We, at the BL25SU, plan MCD spectra measurements and Photoelectron emission microscopy (PEEM) experiment, on 16th. and 17th. of Oct, respectively. So, menus of the practice are difference between the first and the second days.

Outline of BL25SU

BL25SU is designed for research on electronic structures, magnetic states and surface structures of solids with high energy-resolution circularly-polarized soft x-rays. Left- and right-handed circularly polarized radiation is obtained along the same optical axis by twin helical undulators. The helicity of the circularly polarized radiation can be periodically switched at 0.1, 1 or 10 Hz by using kicker magnets distributed around the two undulators. The beamline monochromator is a constant deviation type with varied line-spacing plane gratings covering an energy region of 0.22 ~ 2 keV. The resolving power of the monochromator is more than 10,000 in the whole energy region.

Four kinds of spectroscopic techniques are available for public use: **high energy-resolution photoemission spectroscopy**, **magnetic circular dichroism of core absorption**, **two-dimensional angular distributions of photoelectrons**, **photoelectron emission microscope**. Measurements are performed in ultra high vacuum conditions down to 10^{-8} Pa.

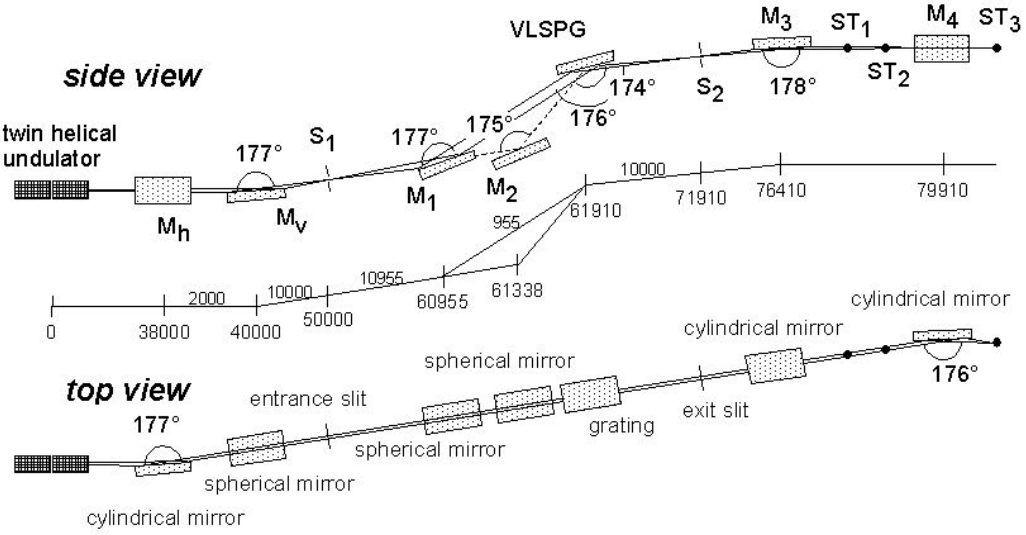

Fig.1 Layouts of beamline optics at BL25SU. MCD apparatus is installed as a station-4 (ST_4) downstream of the ST_3.

Time schedule of 16th, Oct.

9:00- Introduction of beamline design and major scientific activities.
10:00- Sample preparation and introduction to a load lock chamber.
10:30- Introduction of the helicity switching and MCD data acquisition techniques.
11:30- Measurement of beam properties under helicity switching in the 1 Hz mode.
12:30- ------- Lunch ----------
13:30- MCD measurements (Spectra and hysteresis loops). I propose having a time for exchanges of scientific interests and discussion on some technical subjects during the measurements.
16:00- Up to participant's interests and requests.
-17:00 Close

X-ray magnetic circular dichroism

Magnetic circular dichroism (MCD) of soft x-ray absorption is a powerful tool to study magnetic and electronic states of ferromagnetic and ferrimagnetic materials. At BL25SU, helicity switching of circularly polarized radiation performed by the twin helical undulators are used for MCD measurements. Two absorption spectra corresponding to an MCD are measured by one energy scan switching the helicity at each energy point. The helicity-switching method is effective for precise measurements. The switching frequency is currently 1 Hz.

Samples are magnetized by a water-cooled type electromagnet equipped with double yorks. The electromagnet generates variable magnetic field up to 1.9 T at the sample position. Sample temperature can be controlled from 10 K to 300 K and from 300 K to 550 K. Absorption intensity is measured by means of the total electron yield. A combination of the helicity switching technique and the apparatus provides element specific magnetic hysteresis (ESMH) measurements.

Time schedule (PEEM) of 17th, Oct.

9:00- Explanation of photoemission electron microscopy (PEEM) device.
10:00- Sample preparation, introduction to a chamber, surface cleaning.
12:00- ---------- Lunch ----------
13:00- Measurement (magnetic domain images and X-ray absorption/magnetic dichroism spectra of selected areas)
16:00- Free discussion
-17:00 Close

Photoemission electron microscope (PEEM)

Photoemission electron microscope (PEEM) has been of great benefit in the field of surface science. The PEEM device in BL25SU (PEEMSPECTOR) provides the spatial distribution of photoemission electron with the resolution below 100 nanometers. The emitted electrons are primarily magnified by the large difference in electric field between sample and objection lens, and three projection lenses produce the final magnified image on the screen. The photoelectron intensity emitted from the surface is proportional to the x-ray absorption intensity, so that the chemical composition map of specific element can be obtained by this method. Especially, a combination technique with circularly polarized X-rays enables us to visualize a magnetic domain image, making use of magnetic circular dichroism (MCD) or magnetic linear dichroism (MLD) effect. The X-ray absorption and/or MCD spectra at specific areas are also available by taking the images successively, sweeping X-ray energy near the absorption edge. In this practice, we will demonstrate the observation of magnetic domains (XMCD-PEEM images) of some magnetic materials, i.e. Fe single crystal or patterned magnetic media.