Beamline practice at BL12XU

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1. Introduction

The tunable and brilliant third generation synchrotron radiation source allowed to carry out various spectroscopy experiments in hard x-ray region.

The undulator beamline BL12XU is primarily designed for resonant and non-resonant inelastic X-ray scattering (RIXS and IXS) experiments.

Participants at our course will learn knowledge and techniques of Rowland circle type spectrometer which is commonly used in hard x-ray spectroscopy. Practically, we will demonstrate RIXS type experiment, the high resolution x-ray absorption(Ref.[1]), using this spectrometer at transition metal *K*-edge(this time we are thinking to choose Cu compounds as practice sample).

2. Outline of BL12XU

2-1 Beamline

Figure 1 shows schematic view of BL12XU. The beamline consists of main and side line. The main line is mainly used for inelastic x-ray scattering(IXS) experiment. The side line is dedicated to hard x-ray photoemission photoemission spectroscopy(HAXPES) experiment.

Diamond monochrometer(DM) which is located upper most of the beamline introduce monochromatic x-ray to the side line. The beam which comes out from synchrotron is first monochromatized by double crystal monochrometer(DCM). Higher harmonics of the beam is cut and the beam is collimated by collimating mirror(CM). After the collimating mirror(CM) beam is focused at the center of IXS spectrometer using focusing mirror(FM).

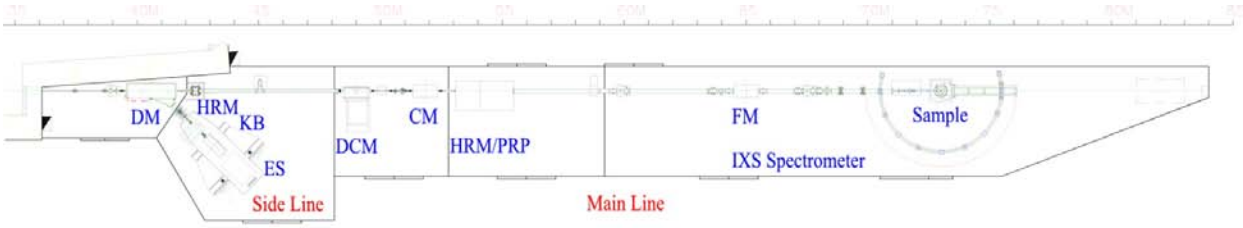

Figure 1 BL12XU

2-2 Inelastic X-ray spectrometer(IXS) spectrometer

Figure 2 shows schematic diagram of RIXS spectrometer.

Fig.2 (a) shows energy scan of Rowland circle type spectrometer. The relation between energy and scattered angle can be calculated using formula shown below. Sample, detector and spherical bent spherical bent single crystal Si or Ge analyzer are moved to maintain the curvature radius of the analyzer. Analyzer is chosen depends on energy of the samples.(see attached Graph at the last page.)

Fig.2(b) shows q scan of IXS spectrometer. Due to short wave length of hard x-ray, it is possible to study q dependent experiment.

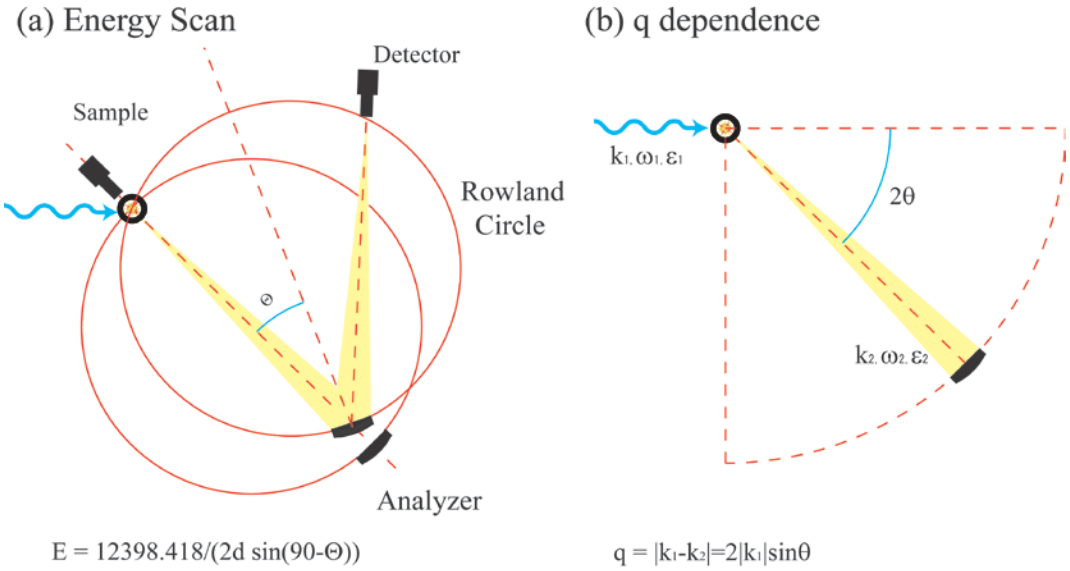

Figure 2 (a)Energy and (b)q scan of IXS spectrometer

3. Schedule

3-1 Introduction of SPring-8 Taiwan beamlines(BL12)

Will introduce BL12.

3-2 Introduction of Inelastic X-ray Spectrometer.

Choose analyzer crystal.

3-3 Experiment

3-3-1 Alignment of beamline

Calibration of DCM energy using transition metal foil *K*-edge absorption.

3-3-2 Alignment of IXS spectrometer

The calibration and optimization of IXS spectrometer will be shown. It will be done by using emission line of transition metal foil.

3-3-3 High resolution x-ray absorption

The detail theory and method of this technique can be found at Ref.[1].

- Transition metal compound Kα or Kβ emission

  Experiment of transition metal compound Kα emission after sample alignment.
- Transition metal K-edge absorption

  Experiment of total fluorescence yield(TFY) mode and High resolution absorption mode at transition metal K-edge.

Reference

[1] K. Hämäläinen, D. P. Siddons, J. B. Hastings, and L. E. Berman, Phys. Rev. Lett. **67**,2850(1991)