The Beam Line BL01B1 for X-ray Spectroscopy (XAFS)

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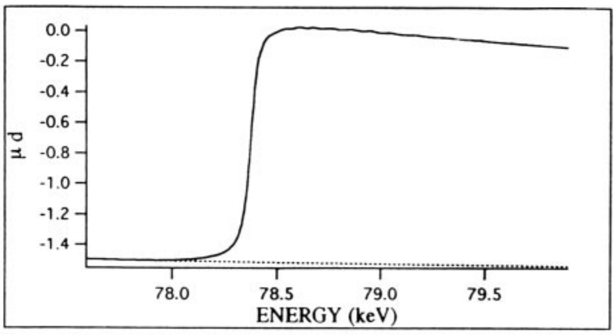
1. Introduction

The beamline BL01B1 is for an x-ray spectroscopy, especially for XAFS measurements, widely ranging from 4.5keV to 90keV. The light source is synchrotron radiation from a bending magnet. The aims of construction of this beamline are to offer to i) high energy x-ray spectroscopy (XAFS in high energy region), ii) precise XAFS including theoretical works, iii) Raman scattering in x-ray and modulation XAFS, iv) x-ray spectroscopy in dilute system. Last Autumn, this beamline was in a trial running and several terms of appraisements such as photon flux, energy resolution and reduction degree of higher harmonics were curried out. The important parameters are shown in Table 1. All in the Table 1 are the values at the sample position. The detailed performance of system and its components will be summarized elsewhere.

Table 1. The specification of the beamline.

Energy range	4.5 ~ 90 keV
Energy resolution	$<2x10^{-4}$
Photon flux	10^{10} ~ 10^{12} Phs/s
Higher harmonics	$< 10^{-5}$
Beam size	0.2 ~ 0.3 mm^2



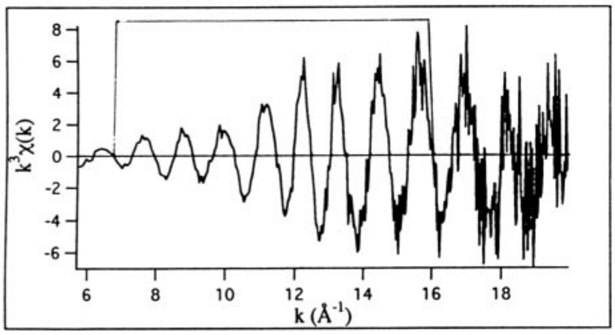


Fig. 1 Absorption spectrum of Pt around K-edge. Left shows a spectrum as observed and right XAFS oscillation

2. Characterization

In high energy region over 40 keV, the several typical spectra to appraise the beamline were measured. The good resolution and high photon flux enable phase problems between *K*-edge absorption and *L*-edge absorption to consider. One of the those is shown in Fig. 1, using double Si [511] crystals. The spectrum was taken a few seconds per sampling point. The XAFS oscillation can be found up to twenty A^{-1}, considering that the effects of the lifetime and mean free path of photo-electrons are obviously recognized.

New theoretical approach is in consideration under inverse problem scheme via wavelet-Galarkin regularization method, and applied to a simple two atom molecular model. This approach has possibility to make XAFS analysis more precise. The wavelet-Galarkin regularization is successfully applied to create clear pictures from noisy one in image processing. The inverse problem approach is more essential to attack solid state physics from XAFS. The theoretical work is one of the important parts of aim of the construction of this beamline.

In low and middle energy range (4.5 keV ~ 40 keV) the mirror performance is checked, and the several spectra were measured to characterize totally the beamline. Figures 2 and 3 show typical spectra. The metal Mo data is the first spectrum of this beamline. The powder In_2O_3 spectra shows a sharp RDF.

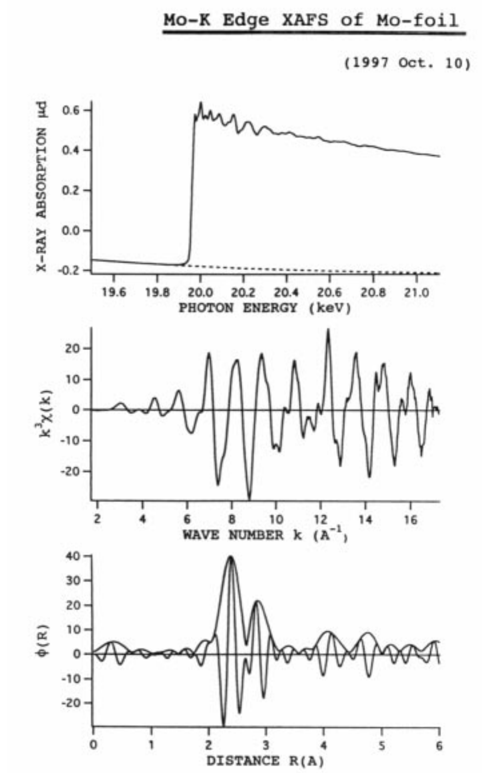


Fig. 2 K-edge absorption spectrum of a metal Mo.

The characterization of the compornents of the beamline is made by JASRI team, team head Tomota Uruga. The construction team of this beamline is measured the characterization spectra, as follows,

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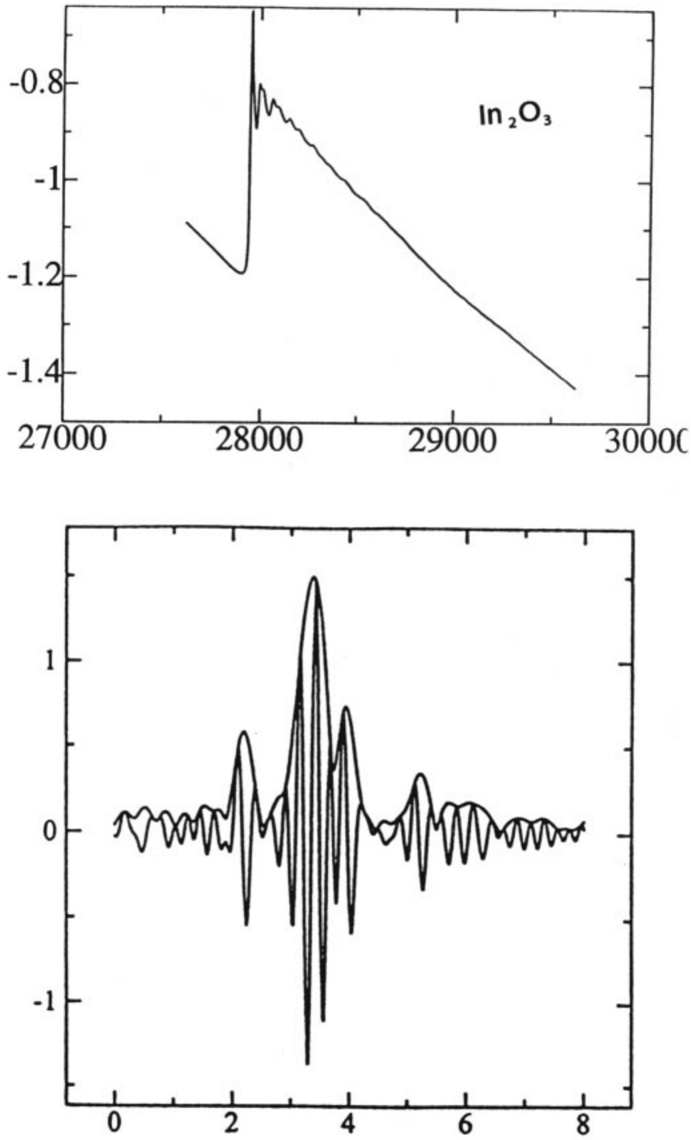

Fig. 3 *K*-edge absorption spectrum of a powder In_2O_3 and its RDF.