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Development of reflectional DXAFS method based on Kramers-Kronig relation

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1 Introduction

Dispersive XAFS (DXAFS) is a powerful technique to study time revolutions of systems [1]. We would like to expand this wonderful technique to the field of surface science in order to study fundamental mechanisms of surface chemical reactions. Spectra measured by transmission include a huge signal of bulk and an almost negligible one of surface, and some new ideas are required. We've tried to extract surface components by detecting signals of total reflection. Total reflection is so surface sensitive that bulk signals should be eliminated. The problem is, however, that a spectrum of total reflection is not absorption one. We need an absorption spectrum, and we've decided to apply Kramers-Kronig relationship to reflection spectra in order to obtain "absorption" spectra.

2 Experiment

XAFS measurements were performed at BL-9C. Normal XAFS spectra were first measrued for Co, Ni and some other metals. Reflection spectra measurements were carried out by using stages for grazing incident measurements. The reflectional spectra were converted to "absorption" spectra via Kramers-Kronig relationship.

The development procedure of the Kramers-Kronig reflectional DXAFS method was carried out at NW2A.

3 Results and Discussion

At the stage of the first trial, a reflection spectrum of Cu was measured. Oscillatory structures were seen, and the spectrum was converted to an "absorption" spectrum. The shape was not ideally identical to a proper Cu XAFS spectrum, but a sharp peak was obtained at the edge. We'd tried to fix some issues to obtain proper spectra.

Figure 1(a) shows spectra of normal XAFS of Co foil and reflection spectrum of Co(30 nm)/Si, which is flipped to compare each other. EXAFS oscillations and their FTs are shown in Fig. 1(b) and (c), respectively. These two show generally similar features, though there're still some differences.

The first trial spectra of reflection DXAFS are shown in Fig. 2. They were recorded for 4 ms every 10 ms. The specific features are seen in the spectra, and the reflection DXAFS measurements can be used to obtain "absorption" spectra via Kramers-Kronig relationship.

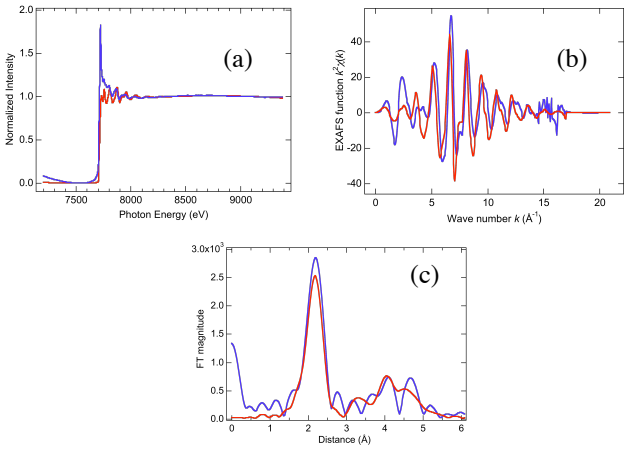

Fig. 1: A usual XAFS of Co foil (red) and reflection of Co(30 nm)/Si (blue), and the processed data.

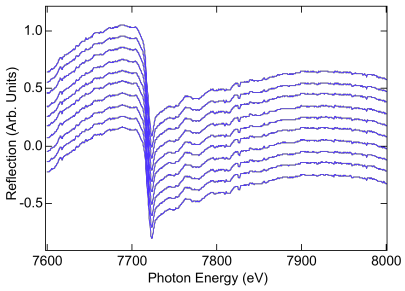

Fig. 2: Reflection spectra of Co(30 nm)/Si (blue) recorded by DXAFS method.

Acknowledgement

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References

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