Wavelength dispersive x-ray fluorescence spectroscopy using monochromatized x-ray excitation

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An x-ray microprobe system at BL39XU is equipped with an energy dispersive (ED) and a wavelength dispersive (WD) x-ray fluorescence spectrometers[1]. The advantage of the WD spectrometer compared to the ED spectrometer is its better energy resolution and the resultant better signal to background ratio. Therefore, the spectrometer can be utilized not only for XRF spectroscopy but also for ultra trace analysis.

Fig. 1 shows an XRF spectrum obtained from a stainless steel (SUS304) foil of 8 μm in thickness. Monochromatized 7.5 keV X-rays were used for excitation, and regions of Cr Kα, Kβ and Fe Kα XRF were measured simultaneously with the data acquisition time of 100s. The XRF spectrum was dispersed with a Si(111) flat analyzer crystal, and the spectrum was detected by using a delay type position sensitive proportional counter (PSPC). Though the obtained energy resolution (35 eV, FWHM@Cr Kα) was slightly poorer than the designed value, the WD spectrometer is attractive to remove interference of XRF signals from neighboring Z elements which can be fatal when using the ED spectrometer.

Beside the energy resolution the background signal was observed around Fe Kα and Cr Kβ regions. The scattered x-rays directly counted by the PSPC made the background higher. To reduce the background the additional shielding around the PSPC is now under construction.

To realize higher energy resolution, a geometry of longer path length was employed. The PSPC was placed outside the chamber, and the background signal became much smaller than that observed inside the chamber. Fig. 2 shows XRF spectrum of the same sample obtained with the Ge(111) crystal. Fe Kα1 was resolved from Kα2.

The high resolution XRF spectroscopy with the monochromatized x-ray excitation has one of the most important subjects, and the various research subjects are now in progress.

Reference

1) S. Hayakawa et al., J. Synchrotron Radiation, 5, 1114 (1998)

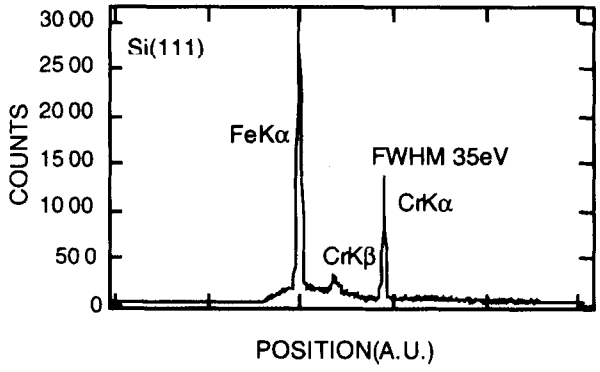

Fig. 1 WD XRF spectrum from a SUS304 foil by using a Si(111) and a PSPC.

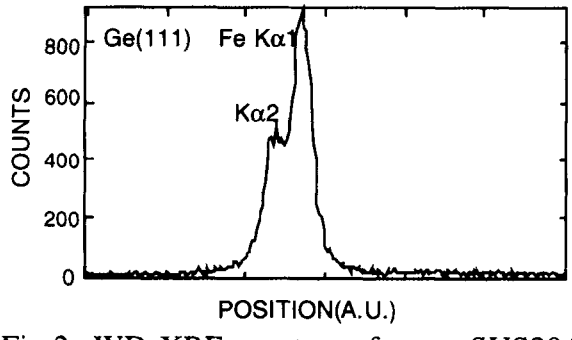

Fig.2 WD XRF spectrum from a SUS304 foil by using a longer path length geometry.