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Refinement of X-ray fluorescence analysis of biological specimens

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1 Introduction

Recently, synchrotron-radiation based X-ray fluorescence analysis (XRF) has become used for biomedicine [1]. However, when we applied XRF to pathological tissue sections, a number of problems need to be solved for optimal measurements, from sample fixation step to sample preparation steps. X-ray energy used for excitation and detectors. In this experiment, we determine the appropriate X-ray energy to detect trace elements, namely transient metals and the exposure time to obtain sufficient signals from tissue samples.

2 Experiment

The same area of sample with same backing film was irradiated by X-ray beam with 10 keV and 11 keV. To change X-ray enegy, double crystal spectrograh placed upstream of the hatch was used to monochromatize the X-ray and change the energy (Figure 1).

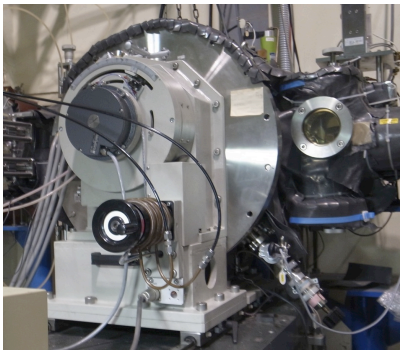

Figure 1 Double crystal monochromator

The resultant fluorescence X-ray was detected by SSD (silicon strip detector, Roentec, Germany) and resultant fluorescence X-ray emission was analyzed with energy dispersive spectrometry (XEDS) shown by the histogram. The poly-capillary X-ray beam was focused to spot size of 20-30 micrometers.

3 Results and Discussion

Histograms of XEDS obtained by exposure to X-ray energy of 10 keV and 11 keV were compared. As shown in Figure 2, while the elastic scattering peak (Thomson scattering) indicated by asterisk was high in both histograms. The Zn peak in 10 keV (upper panel) was slightly buried in the Thomson scattering peak, the Zn peak in 11 keV (lower panel) was clearly separated due to the slight X-ray emission energy shift to the high energy range.

Therefore, the irradiation by incident X-ray with 11 keV for was better than 10 keV in BL4A especially for Zn detection. It should be mentioned that the 10 keV exposure with much brighter X-ray in SPring-8 did not cause this kind of interference, probably due to relatively low Thomson peak from backing materials[2].

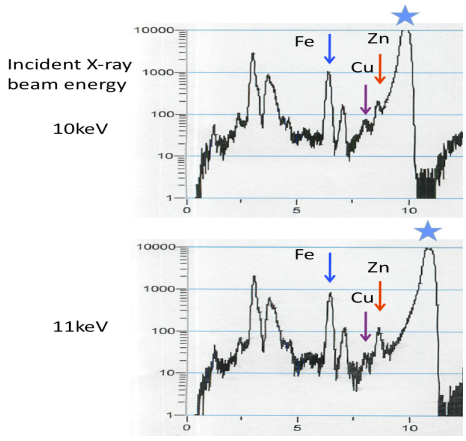

Figure 2 Comparison of XEDS histograms with different X-ray energy.

4 References

[1] Paunesku T et al. *J Cell Biochem* 99, 1489-1502 (2006).

[2] Matsuura A et al. *Wilson disease soc bullent.* 18, 11(2014)

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