Study of Matrix Effect with a Full-Field Imaging X-ray Fluorescence Microscope

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When two or more elements in a specimen are analyzed simultaneously by x-ray fluorescence with a microprobe, a matrix effect causes not only a degradation of quantitative analysis but also the broadening of the apparent spot size of the microprobe. A full-field imaging method has potential to solve this problem because it can specify the point of the specimen where the x-ray fluorescence photon generates. In addition, the effect of secondary excitation should be corrected by considering 3-dimensional elemental distributions of the specimen. Therefore, we have been developing a full-field imaging microscope and performing x-ray fluorescence microtomography for the quantitative observation of elemental distributions of Fe and Ni in a synthesized diamond [1]. For more accuracy of the quantitative analysis, the matrix effect and other influential effects were observed and discussed in this presentation.

A full-field imaging x-ray fluorescence microscope system was constructed at BL3C2 in the Photon Factory (KEK). A quasi-monochromatic beam from a double multilayer monochromator was used as an excitation beam. X-ray fluorescence from a sample was imaged by the Wolter mirror (×10) onto a CCD camera. The mixture solution of $FeCl_2$ (II) (3.2 mol/l) and $NiCl_2$ (0.8 mol/l) in a glass capillary tube (ϕ: 300 μm) was used as the sample. Its x-ray fluorescence image was acquired with the limited irradiation area of the sample. A photon counting image of Fe Ka line is shown in Fig. 1. Its exposure time was 0.8 sec×1000 and the excitation energy was 8.40 keV. The x-ray fluorescence image can be seen outside of the irradiation area. These tails were caused by the excitation due to the matrix effect and the scattered incident beam.

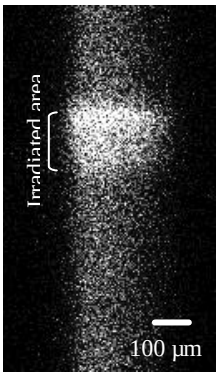

Fig. 1: Photon counting image of Fe Ka line of the mixture solution sample.

[1] T. Ohigashi, N. Watanabe, H. Yokosuka and S. Aoki, *AIP Conference Proceedings*, **705**, (2004), 1352-1355.