Quantitative analysis from stigmatic isotope imaging of SIMS

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Introduction

Direct ion imaging with secondary ion mass spectrometry (SIMS) has been developed in various fields, such as Material sciences, Earth and planetary sciences, life sciences. Especially, quantitative direct ion imaging techniques has recently developed using stigmatic direct ion imaging methods (e.g., [1], [2]).

Experimental:

In this study, we try to develop the stigmatic secondary ion imaging methods using Cameca ims-4fE7 SIMS at Kyoto University. The imaging detector system consists of micro-channel plate (MCP), florescent screen and Cooled 16bit charged-coupled device (CCD) camera (BU-LN52 Bitrun Co.). This conventional imaging system needs to estimate the calibration parameter with conversion from ion to electron, and from electron to photon. In Fig.1., the conversion between ADU/s/pixel and secondary ion intensity are shown. The integrated ADU is about 10^4/pixel. The CCD image is 512x512pixel. The magnification of secondary ion image is about 0.4μm/pixel. The five area denotes 50x50pixel. The calculation of conversion function shows the average value of five area.

Results and Discussion:

In principle, each micro-channel of MCP would be varied for conversion parameter. Therefore, in order to estimate the quantitative of isotope image using this system, we need to estimate the error of this conversion parameter in different location of each channel.

In this talk, we introduce the estimation of calibration parameter between the light output count rate read by CCD camera and the count rate of secondary ions incident on MCP with different experimental session. We will estimate the error of each nonlinear exponent parameter for five places (50 x 50 pixels) and these different parameters cause the error of about 5%. We will discuss it in detail with quantitative isotope imaging with application to search the presolar grains from the acid residue of meteorite samples and in-situ analysis of meteorite samples.

[1] Nittler, 1996, PhD thesis, Dept. of Physics, Univ. of Washington [2] Yurimoto et al. (2003) Appl.Surf.Sci., 203-204, 793-797.