Development of micro-tomography imaging system for rock and mineral samples

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A micro-tomography imaging system has been developed at the SPring-8 using its synchrotron radiation.

An "in-vacuum type" undulator is employed as an X-ray source. Transmission image is measured with an image detector that consists of a phosphor screen, relay lens, and cooled CCD camera. Convolution back projection method is used to reconstruct tomographic images.

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A micro-tomography imaging system has been developed at the SPring-8. An "in-vacuum type" undulator is employed as an X-ray source, and undulator radiation is monochromatized with a liquid nitrogen cooled Si(111) double crystal monochromator. X-ray energy region is 5-35 keV. Cross section of the monochromatic X-ray beam is 2 mm x 1 mm. At present, the field of view is restricted by the X-ray beam size. However, this highly collimated undulator radiation from the low emittance storage ring is very suitable for high resolution micro-tomography. Flux density of the monochromatic beam is around 10E13 photons/s/mm2 at the sample position, and angular divergence is less than 20 micro-radian. Transmission image is measured with an image detector that consists of a phosphor screen, relay lens, and cooled CCD camera. Convolution back projection method is used to reconstruct tomographic images.

As the result of performance test, spatial resolution was about 20 micrometers. Three-dimensional structures and texures of some rocks and other materials were obtained by using the tomography system as a preliminary result. They were micro granites(1.0mm x 0.8mm x 0.7mm cut), pumice from Sakurajima volcano(1.0mm diameter x 0.8mm) and chondrules from Allende meteorite(1.0mm diameter).

We are going to analyse these data in detail and improve this micro-tomographic imaging system to achieve better spatial and density and/or CT value resolutions. At the meeting, the results of further investigations and the enhanced performance of the CT system will be presented.