Hard X-ray Diffraction Microscopy at SPring-8

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X-ray diffraction microscopy is an innovative method to reconstruct high-spatial-resolution images from oversampled Fraunhofer diffraction intensities of non-crystalline samples. As the ultimate spatial resolution is limited by the x-ray wavelength and for biological samples by radiation damage, shorter-wavelength hard x-rays are beneficial to achieve higher resolution. Using the hard-x-ray beamline BL29XUL at SPring-8, we have been developing x-ray diffraction microscopes, and have shown the usefulness of the method [1-3].

In the x-ray diffraction microscopy experiment, it is desirable to reconstruct the sample image in parallel with conducting experiment in order to get quick feedback from the measurement. In early dates, the problem of missing central data due to a beamstop hindered it, because a supplemental experiment has been required to restore low-resolution information. To solve the problem, we developed a new reconstruction algorithm which is effective even with relatively-large missing central data [3]. In addition, we are developing a dynamic reconfigurable processor to quickly perform fast Fourier transform, which will be used to perform faster image-reconstruction.

To achieve higher spatial resolution, the development of larger-area detectors is essential. We are developing a large-area in-vacuum imaging plate detector and a vacuum chamber for it, and are planning to evaluate their performance in the immediate future.

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