Projection-type micro X-ray fluorescence and diffraction imaging

Kenji Sakurai

National Institute for Materials Science (NIMS),Sengen, Tsukuba, Ibaraki 305-0047 JAPAN

This paper concerns the recent instrumentation for projection-type imaging for X-ray florescence and diffraction. The method is quite different from normal scanning type imaging, which has been widely used at many synchrotron beamlines all over the world. The present instrument uses quite a wide beam (typically 8mm (H) × 0.2mm(V)), which illuminates the whole sample surface in a low-angle-incidence arrangement (0.5~1.5 deg). The detector used is a CCD camera based on TC281 (Texas Instruments) working at 30 fr./sec, equipped with a collimator inside, and the distance between the sample surface and the detector is set extremely close, in order to enhance both spatial resolution and efficiency. In order to distinguish elements effectively, most of the experiments were performed with monochromatic or quasi-monochromatic X-rays. The experiments at BL-16A1, a multipole wiggler beamline at the Photon Factory, indicate that the typical exposure time is 30-300 msec for one XRF image (1000×1000 pixels) corresponding to 0.64 mm^2 area with a spatial resolution of ca. 15-20 micron. Furthermore, in addition to the normal XRF, one can perform X-ray absorption fine structure (XAFS) and X-ray diffraction (XRD) imaging by repeating exposures with a synchronized scan of the primary X-ray energy. Therefore one can analyze the distribution of the chemical composition, the crystal structures, the orientation, the lattice strains, chemical states, and inter-atomic distances simultaneously for inhomogeneous sample within very short time. From a viewpoint of the application to the materials science, in particular to combinatorial research, not only the use of synchrotron radiation but also new X-ray microscopes with laboratory source would be demanded. Recent developments will be introduced at the conference.

References

Japanese Patent No.3049313, K.Sakurai and H.Eba (2000).

K.Sakurai and H.Eba, *Anal. Chem.* 75, 355 (2003).

K.Sakurai and M.Mizusawa, *Nanotechnology,* **15,** S428 (2004).