X-ray elemental and structural imaging techniques by using highly sensitive X-ray camera

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It is important to obtain elemental and structural information for understanding chemical reactions. Full field ED-XRF (FF-EDXRF) imaging technique is useful for multi-elements simultaneous imaging. The primary x-rays are irradiated on the sample with a large area. XRF signals emitted from the sample are measured by an X-ray camera. A single photon counting analysis is applied for energy analysis of the XRF [1]. Since the number of the electron hole pairs depends on the energy of the XRF, we can know the kind of the element in the sample. FF-EDXRF imaging spectrometer was developed at Osaka City University by taking the kind suggestions from Dr. P. Romano [1,2]. XRF emitted from the sample was introduced to the X-ray camera through a straight type polycapillary optic. An exposure time was controlled by using x-ray shutter. For the industrial samples, multi-elemental XRF imaging was obtained. The XRF images were strongly changed with the glancing angles. This GI-XRF imaging will be discussed.

Concerning XRD imaging, a straight type polycapillary optic and a 2D X-ray detector were applied to the XRD spectrometer [3,4]. Cu Kα X-rays were irradiated on the metal samples. The intensity distributions of the diffracted X-rays were detected by a highly sensitive X-ray detector (HyPix-3000, Rigaku, Japan) through the straight type polycapillary optic (channel diameter: 10 μm, effective optic diameter: 6 mm, optic length: 20 mm, XOS, USA). The oxidation process of the rolled Cu plate was monitored at 573 K by XRD imaging technique. Cu (111) peak was dominant before the oxidation, while Cu_2O (111) and CuO (-113) diffraction peaks gradually increased as the oxidation time increased. This chemical change in the surface layer was visualized by XRD imaging technique.

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