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# Texture imaging of aluminum sheet by a projection-type X-ray microscope

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## Introduction

X-ray diffraction (XRD) imaging of polycrystalline materials is a significant scientific tool [1]. Recently, it was found that it is possible to perform an extremely efficient imaging experiment using a projection-type X-ray microscope with a completely fixed geometry [2], which was developed originally for X-ray fluorescence [3]. This report describes the first report on its application to texture observation.

## Experimental

The experimental geometry is shown in Fig.1. The instrument used is essentially the same as a projection-type X-ray fluorescence (XRF) microscope, the details of which are described elsewhere [2,3]. The procedure for XRD imaging is simply a repetition of the exposure of a CCD camera as a function of the energy of the incident monochromatic X-rays. The beam size is 13mm (H)×0.2mm(V). Typical exposure time for one image was 3 sec.

## Results and Discussion

Figure 2 shows an X-ray image of a metallic aluminum sheet 1mm thick, obtained at an incident X-ray energy of 7154 eV, which corresponds to (311) reflection (2d=2.442Å). One can see a stripe pattern, which agrees well with the rolling direction. Such an XRD image can be observed for rather a wide energy range, typically ±50 eV. In this case, the sample surface was polished with 0.05μm alumina powders to remove any rolling marks and possible scratches. Therefore, the image does not reflect the surface shape but the texture of the rolled sheet. Since the spatial resolution of the present X-ray microscope is 15~20μm, the shape of the crystal grains in each stripe is not clearly visible. Small random spots, independent of the rolling direction, are also observed in the whole area. It was found that the number of such spots increases when a much thicker sample is measured.

In the present experiment, XRD images were observed only at 6102 eV and 7154 eV, which correspond to (220) and (311) reflections, respectively. In both cases, similar stripe patterns were observed, although they were not observed for other reflections. Furthermore, it was found that such stripes along the rolling direction weakened when the incident beam was parallel to the rolling direction. The results correlate strongly with the preferred orientation of the texture, formed during the cold press and rolling process. The present new method for XRD imaging would be feasible for studying the texture of inhomogeneous polycrystalline materials. The authors would like to thank Professors H. Sawa, Y. Wakabayashi, and Y. Uchida, for their kind cooperation during the experiment.

## References

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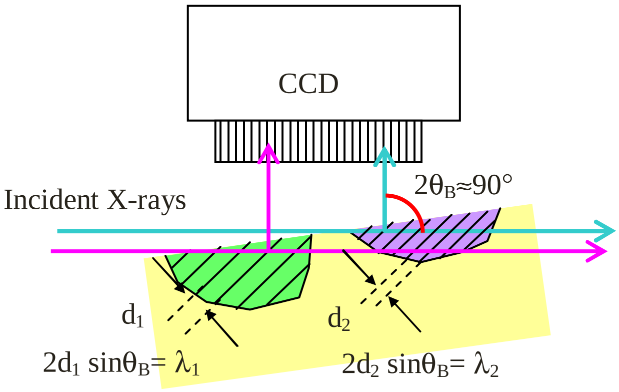


Figure 1 (top) Schematics of XRD imaging based on a completely fixed geometry.

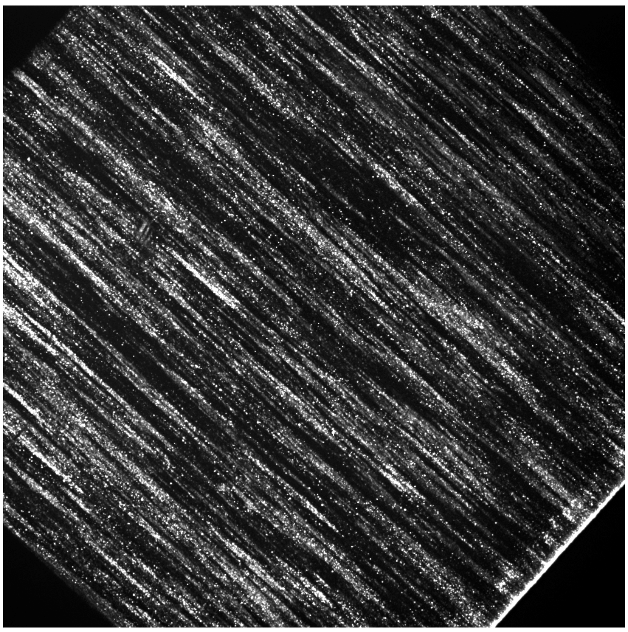

Figure 2 (right) (311) diffraction image of aluminum sheet. Exposure time, 3 sec × 30 times. Incident X-ray energy and scattering angle were 7154eV and 90.4°, respectively. X-rays are coming from the right in this image.