

# Development of High-Precision Slit Blades for Soft x-ray Transmission-Grating Spectrometer

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We have developed a newly developed transmission-grating spectrometer for high resolution soft X-ray emission studies. This spectrometer is designed to realize a resolution  $E/\Delta E$  up to 5000 in the energy region of 50-600 eV with high throughput [1]. The spectrometer has a Wolter type I premirror, a free-standing transmission grating, and a back-illuminated CCD. The Wolter mirror with a high collection angle of  $1.5 \times 10^{-3}$  sr enables higher throughput than the conventional spectrometer. In order to obtain high energy resolution, an entrance slit with the minimum slit opening of 1 micron has been developed. In order to maintain the spectrometer efficiency, the distance between the sample and the slit is designed to be less than 150 micron. Because of the limited space between the sample and the Wolter mirror, the entrance-slit system is required to be movable and within the thickness of 13 mm. These requirements demand a development of slit blades smaller than  $13 \times 10 \times 2.5 \text{ mm}^3$  with a roughness of less than 0.3 micron. The blades were fabricated by using a high-precision polishing process. The sides A and B (Figure 1) were polished in the first place. The resulting roughness was less than Ra 7 nm. The edge surfaces were polished by using a clamp as shown in Figure 2. The four blades were pressed by the two plates via two screws so as to minimize the gap between the blades. The pressure was optimized so that the pile up did not occur during the polishing process. Figure 3 is the top view of the slit blade from A side. The edge roughness was estimated by secondary electron microscope and was about 0.3 micron.

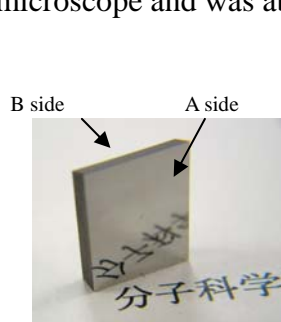


Figure 1. Photograph of a slit blade

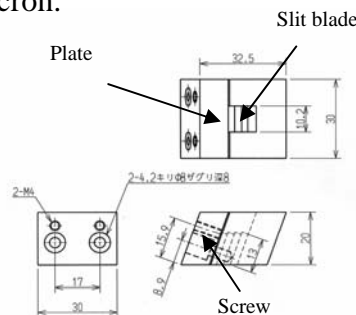


Figure 2. The clamp for polishing the edge surfaces

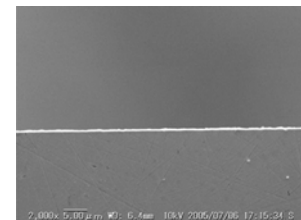


Figure 3. Top view of a set of slit blades observed by SEM