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B 1*s* σ and π emission spectra from CrB_2 and ZrB_2 measured with a polarization spectrometer based on a multilayer grating

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Introduction

A multilayer-coated grating is expected to act as a polarizing dispersion element around an incidence angle of 45° in the soft X-ray region because of the Brewster reflection. It enables us to construct a polarization spectrometer for soft X-rays with a few optical elements and thus with a simple geometry. In the previous study we deposited a Mo/B_4C multilayer coating to a laminar grating of 2400 grooves/mm and 1-m radius of curvature. The efficiency was evaluated to be 3.1% for *s*-polarized radiation of 6.7-nm wavelength. The polarizance was estimated to be higher than 98.9% [1].

Experimental

We constructed a polarization spectrometer based on the multilayer-coated grating in a Rowland circle mounting as shown in Fig. 1. The angle of incidence for the grating is about 45°. The width of the entrance slit is 0.08 mm, which provides an energy resolution of 0.9 eV at about 180 eV. As a performance test for the spectrometer we carried out emission experiment at BL-16B. The samples were CrB_2 and ZrB_2 single crystals, which have a layer structure like MgB_2. Their B 1*s* emission consists of σ and π emission, which are polarized in the direction perpendicular and parallel to the *c*-axis, respectively.

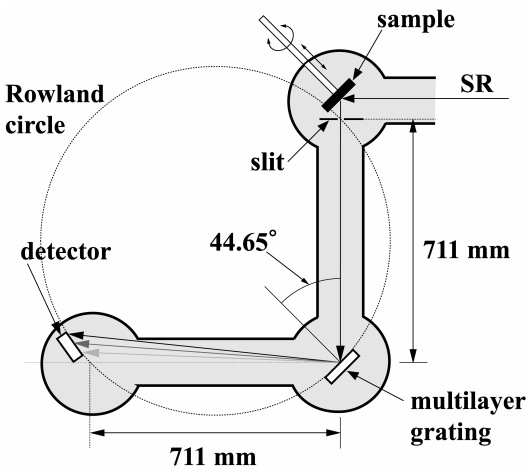

Fig. 1 Schematic layout of the spectrometer.

Results

Figures 2 and 3 show the B 1*s* σ and π emission spectra with the solid and open circles for CrB_2 and ZrB_2, respectively. The σ and π emission spectra were measured when the *c*-axis was oriented in the direction parallel and perpendicular to the incidence plane, respectively. The σ and π emission spectra were independently obtained for the first time in the soft X-ray region. The spectral feature is fairly consistent with the band calculation [2].

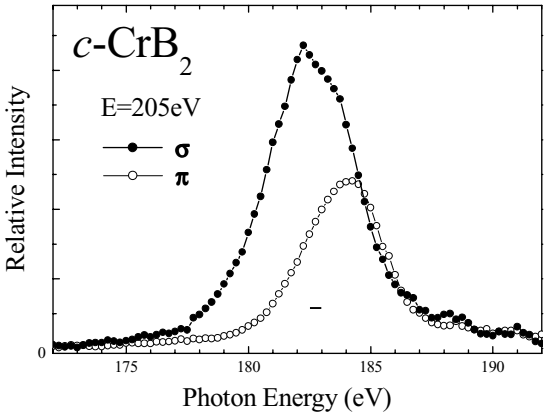

Fig. 2 B1*s* emission spectra from CrB_2.

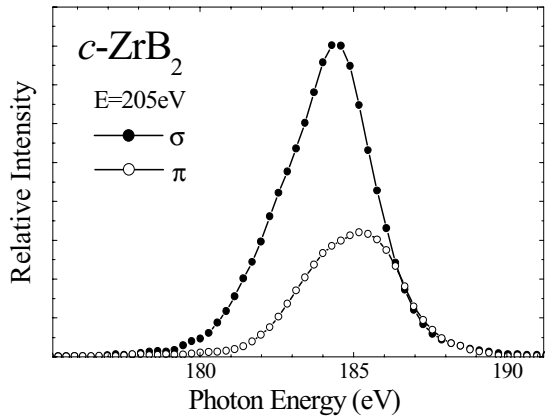

Fig. 3 B1*s* emission spectra from ZrB_2.

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