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ABSOLUTE SENSITIVITY OF THE VUV SPECTROGRAPH FOR PLASMA DIAGNOSTICS

Masayuki YOSHIKAWA*[1], Yuusuke KUBOTA[1], Takayuki KOBAYASHI[1] and Ken MATAMA[1]
[1]Plasma Research Center, University of Tsukuba, Tsukuba, Ibaraki 305-8755, Japan

Introduction

Measurements of spatial and temporal variation of spectra in the wavelength range from vacuum ultraviolet (VUV) to soft x-ray (SX) are necessary to determine radiation power losses and ion density profiles which directly relate to the impurity transport, confinement and sources in magnetically confined plasmas. We developed space- and time-resolving VUV (150-1050 Å) [1] and SX (20-350 Å) [2] spectrographs and applied for impurity diagnostics in the tandem mirror GAMMA 10 [3].

For quantitative analyses of emission lines, it is important to characterize the absolute sensitivity of these spectrograph systems throughout their wavelength ranges. We have changed the recording camera for improving the sensitivity of the VUV spectrograph. We measured the absolute sensitivities of VUV spectrograph. In order to observe the wider spectral wavelength range of the emissions from the plasma, we change the incident light angle of the VUV spectrograph. In this report, we show the wavelength range of the VUV spectrograph by changing the incident light angle of the spectrograph with using a new CCD camera.

Experiments

In the space- and time-resolving VUV spectrograph, a concave grating ruled with varied spacing (Hitachi P/N001-0266) is used, which has a radius of curvature of 500 mm, a nominal groove density of 1200 g/mm and a ruled area of 48 × 48 mm^2. The nominal incident angle is 51° and the effective braze wavelength is 60 nm. The incident angles of 50.6°, 51°, and 51.4° are corresponding to the slit positions at 32.0 mm, 34.2 mm, 36.0 mm. The entrance slit is a 6-mm in height and 100-μm in width. A MCP intensified detector having 50 × 50 mm^2 active area is set on the flat field output plane. The newly installed recording system of spectral image is a CCD camera (Sony XC HR-50) with a scanning controller. The resolution of video image is eight bit. The maximum frame rate with full image size, 640 × 480 pixels, is 30 frame/s and the shutter speed can be changed from 1 to 125 ms.

The experiments have been carried out at BL-11C. The incident photon intensity was monitored just behind the entrance slit by using an absolutely calibrated XUV silicon photodiode (IRD AXUV-100G). The output spectral image was recorded by the CCD camera. Measurements are repeated for wavelength range from 35 nm to 140 nm at the BL-11C with 5 nm intervals. Incident angle was changed with changing the incident slit position of the VUV spectrograph at 32.0 mm, 34.2 mm (nominal position), and 36.0 mm.

Results

Figure 1 shows the relative observable wavelength range of the VUV spectrograph by changing the incident slit position at 32.0 mm, 34.2 mm, and 36.0 mm. The observable wavelength range of the VUV spectrograph is about 29.0-123.6 nm at the incident slit position of 32.0 mm, 29.5-129.1 nm at the 34.2 mm, and 35.7-130.9 nm at the 36.0 mm.

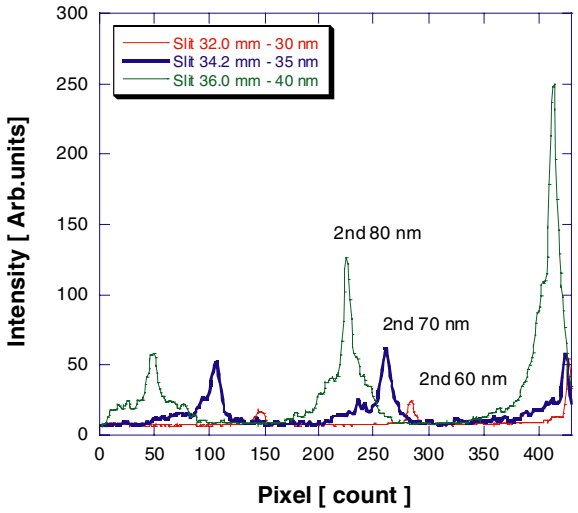

Fig. 1 Relative observable wavelength range of the VUV spectrograph by changing the incident slit position at 32.0 mm, 34.2 mm, and 36.0 mm.

References

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* yosikawa@prc.tsukuba.ac.jp