

Absolute calibration of a soft x-ray grazing incidence spectrometer for highly charged ion plasma observation

多価イオンプラズマ計測用軟 X 線射入射分光器の絶対較正

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Interest in spectroscopy of highly charged ion (HCI) plasmas has increased in the last decade due in part to the development of efficient and powerful extreme ultraviolet (EUV) and soft x-ray (SXR) sources. They have been pursued for applications in EUV lithography, x-ray microscopy, and so on. Instead of discrete line emission, intense unresolved transition arrays (UTAs) emission from HCI plasmas is potentially suitable for the concept of laboratory scale high power sources [1]. In particular, laser-produced plasmas of high-Z elements with $Z = 60 - 83$ produce intense UTA emission between 1 and 10 nm, whose peak wavelengths follow a quasi-Moseley's law [2]. The diagnostics of these plasmas requires spectral data of the emission involved over a wide range wavelengths, from which the plasma parameters such as ion charge state and temperature can be determined. However, the fact remains that there are much less databases of quantitative spectrographs in SXR spectral region were reported, particularly in the wavelength range from 5 to 10 nm. In this study, we evaluate the absolute response of a flat-field grazing incidence spectrometer (GIS) for HCI plasmas spectroscopy in the spectral region from 1 to 10 nm. To produce accurate intensity-calibrated spectra of the HCI plasmas, the diffraction efficiency of a 2400 lines/mm grating and the sensitivity of a x-ray CCD camera is directly measured by use of the reflectometer installed at the BL-11D beamline of the Photon Factory (PF). We also present a detail production of the calibrated spectra [3] and absolute output of the laser-plasma x-ray laser.

[1] T. Higashiguchi *et al.*, Appl. Phys. Lett. **100**, 014103 (2012).

[2] H. Ohashi *et al.*, Appl. Phys. Lett. **104**, 234107 (2014).

[3] T. H. Dinh *et al.*, submitted to Rev. Sci. Instrum.