

Design of the calibration setup for VUV spectrometers using calibrated photo-diode detector in the wide range of VUV wavelength

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The primary role of VUV (vacuum ultra-violet) spectrometers in MCF (magnetically confined fusion) devices including future tokamak such as ITER is to measure the impurity species in plasmas. To perform the post analysis of the acquired VUV spectra from line integrated emission, it is necessary to calibrate the raw data using the intensity calibration curve as the first step. Therefore the absolute intensity calibration of VUV spectrometers has attained its importance by many researchers. However the calibration in VUV wavelength range in the laboratory scale is limited because available calibration light sources are limited, therefore the calibration of VUV spectrometer has been performed using the beam line of the large accelerator device. In the present study, thanks to the recently developed calibrated Si photodiode detector (VUV Si Detector, calibrated in NIST, McPherson 5 - 1000 nm), the calibration setup was designed also including a dedicated VUV spectrometer to select the specific wavelength to be calibrated. Two VUV light sources were employed for this calibration setup in the laboratory scale. A hollow cathode lamp with He, Ne, and Ar gases, which was developed in Hanover university, is used for the wavelength range from 23 nm to 160 nm. The other light source multiple anode SXR source (e-beam + target light source), Model 642-1 from McPherson Co. Ltd. is employed for wavelength range of 1 nm - 20 nm. The dedicated spectrometer was also designed to select the specific wavelength through aperture in the imaging plane, and the Laminar-type Replica Diffraction Gratings for Soft X-ray Region from Shimadzu Co. Ltd. was used for these full wavelength ranges of VUV light. By installing the docking system of the photodiode in the end of the spectrometer beam line, the input photon numbers to be entered into the VUV spectrometer to be calibrated can be measured *in-situ*. The spectrometer to be calibrated is to be connected to the vacuum flange after this photo-diode docking system. By this design of the calibration setup, VUV spectrometers for the wide wavelength range of 1 nm - 160 nm are expected to be able to be calibrated.