ECPD 2021
European Conference on Plasma Diagnostics

A complete set of extreme ultraviolet (EUV) spectrometers for observation of W^{4+}-W^{63+} tungsten ions in the EAST tokamak with full tungsten divertor

Ling ZHANG [1], Yunxin CHENG [1,3], Shigeru MORITA [2], Ailan HU [1*], Wenmin ZHANG [1,4], Fengling ZHANG [1], Zong XU [5], Shouxin WANG [1], Yinxian JIE [1], Haiqing LIU [1], Liqun HU [1]

1) Institute of plasma physics, Chinese Academy of Sciences, Hefei 230026, China

2) National Institute for Fusion Science, Toki 509-5292, Gifu, Japan

3) University of Science and Technology of China, Hefei 230026, China

4) Dalian University of Technology, Dalian 116024, China

5) Advanced Energy Research Center, Shenzhen University, Shenzhen 518060, China

E-mail : ailanhu@ipp.ac.cn

In the EAST tokamak upper and lower graphite divertor plates have been replaced by tungsten monoblock plates in 2014 and 2021 respectively to investigate the tungsten divertor operation. In the present EAST experiment, therefore, studies on the tungsten behavior are crucially important for improving the plasma performance [1]. For the purpose, recently, a complete set of compact flat-field extreme ultraviolet (EUV) spectrometers consisting of four fast-time-response EUV spectrometers [2] and four space-resolved EUV spectrometers [3] has been developed for observation of EUV spectra from W^{4+}-W^{63+} tungsten ions and their radial profiles.

The fast-time-response EUV spectrometers working at 6-65 Å, 40-190 Å, 160-385 Å and 245-500 Å respectively record the high spectra-resolved EUV spectra each 5 ms per frame. And the space-resolved EUV spectrometers covering a large plasma region of Z=−45 - 45 cm (at R=1.9 m) observe the tungsten line intensity profiles with high spatial resolution of 0.5-0.8 cm. The EUV spectra emitted from W^{4+}-W^{45+} ions and their profiles have been observed in the EAST plasma with T_{e0}=0.2 - 4.0 keV. Then, in the coming 2021 EAST campaign observation of the E1 and M1 transition from W^{46+}-W^{63+} ions at 6-10 Å and 30-200 Å will be attempted for the high T_e plasma, e.g. T_{e0}=4 - 10 keV. This upgraded new set of tungsten spectroscopic diagnostics will provide a full information of tungsten behavior from plasma edge to core plasma region with high temporal and spatial resolution simultaneously, which will become a powerful tool to study the tungsten transport in EAST tokamak.

References

[1] Zhang L. *et al* 2017, Nucl. Mater. Energy **12** 774

[2] Zhang L. *et al* 2015, Rev. Sci. Instrum. **86** 123509

[3] Zhang L. *et al* 2019, Nucl. Instrum. Meth. A **916** 169-178