Study on spectra of high-ionization-stage tungsten ions in EAST Tokamak

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It has been decided to use tungsten as the material of first wall and divertor in ITER, because of the high melting point and the low sputtering rate of tungsten. However, impurity tungsten ions always accumulate in the core region, resulting in degradation of confinement performance or plasma disruption. Therefore, suppression of impurity tungsten accumulation in the core region is one of the most challenges for ITER to achieve steady-state high-performance operation. ITER-like tungsten divertor has been used in EAST. Even wall conditioning methods, such as Lithium coating, are applied, plasma disruptions caused by impurity W accumulation also frequently happen during the EAST experimental campaign. Observation of high ionization-stage tungsten ions emissions from the core region is essentially important for studying the method suppressing tungsten accumulation.

Due to complication of impurity tungsten spectra in fusion plasma, it is still very difficult to evaluate the impurity tungsten density in the core region of ITER. X-ray crystal spectroscopy (XCS) has also been planned to observe impurity tungsten (W) emissions from core region in ITER. In EAST, space-resolved extreme ultraviolet (EUV) spectroscopy and X-ray crystal spectroscopy (XCS) have been developed to observe the spatial distribution and temporal behavior of core impurity emissions [1-3]. ITER-like W wall are used in EAST for the low sputtering-rate, A lot of spectra of high ionization stage W ions can be observed in the soft X-ray range. Therefore, it is very meaningful to study spectra of high ionization stage W ions (XCS) in EAST.

Besides, one new middle-energy-range electron beam ion trap (EBIT) device is developed for studying W spectra with electron beam energy of 0-30keV, which is the dominant energy range of fusion plasma. The with FAC atomic code is also used to simulate the wavelength of spectra from high ionization stage W ions.

References

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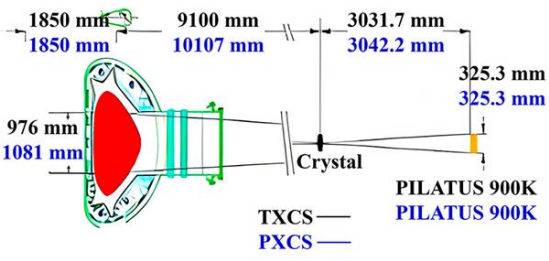

Fig.1 Schematic view of XCS in EAST

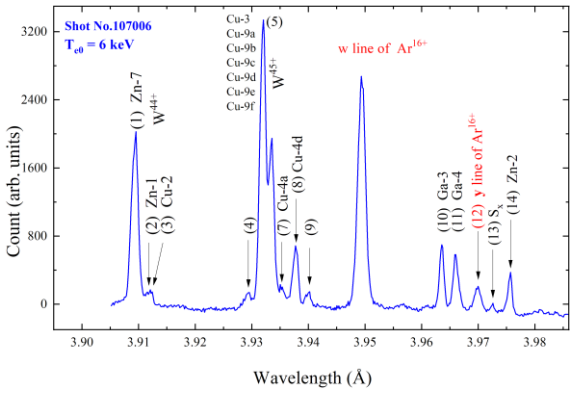

Fig.2 XCS spectra in EAST