EX/P6-38

Development of quantitative atomic modeling for tungsten transport study using LHD plasma with tungsten pellet injection

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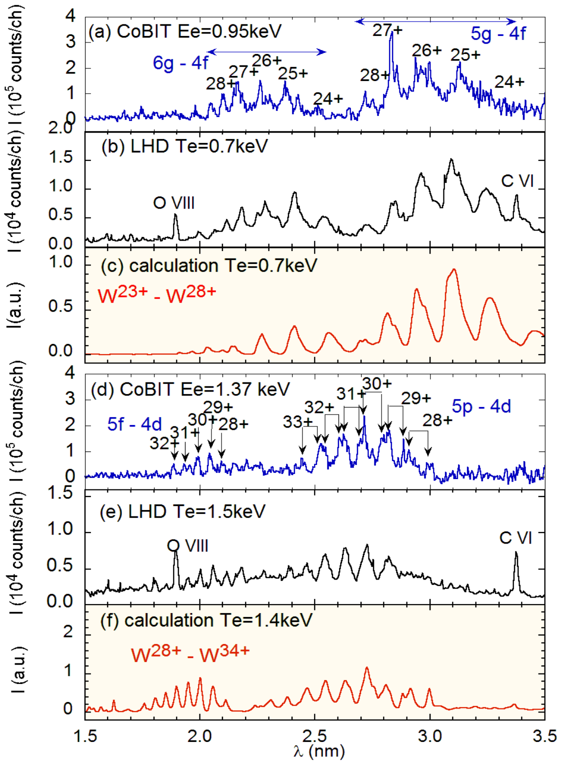

Fig. 1 EUV spectra of tungsten ions; (a, d) CoBIT with two electron beam energies E_e, (b, e) LHD with different electron temperature T_e, and model calculations for (c) W^{23+} - W^{28+} and (f) W^{28+} - W^{34+} ions. Wavelengths in calculation at (c) are shifted by -0.15 nm to fit the position to measurements.

- We have developed tungsten atomic modeling *for understanding the tungsten behavior in fusion plasmas.*
- *We observed tungsten spectra from plasmas of the Large Helical Device (LHD) with tungsten pellet injection and applied the modeling for the analysis.*
- *Our tungsten atomic model can reproduce two-peak unresolved transition array (UTA) feature seen in extreme ultraviolet (EUV) spectra at 5-7nm for plasmas with electron temperature 1 – 1.5keV.*
- *We identified EUV lines of W^{24+} to W^{33+} ions at 1.5 – 4nm by using compact electron beam ion trap device (CoBIT) and these lines are measured in LHD plasmas. They are very sensitive to electron temperature (T_e) and useful to examine the tungsten behavior in edge plasmas (Fig. 1). The charge state distributions are obtained by analyzing these lines with the atomic model (Fig. 2).*
- *Based on the first quantitative analysis of measured spatial profile of W^{44+} ion, the tungsten concentration is determined to be $n(W^{44+})/n_e$= 1.4x10^{-4} (Fig. 3) and the total radiation loss is estimated as ~4 MW, of which the value is roughly half the total NBI power.*

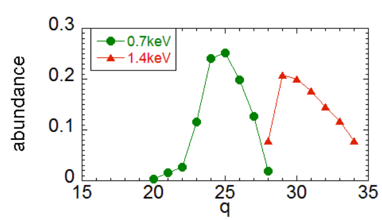

Fig. 2 Charge state distribution obtained from spectra shown in Fig. 1

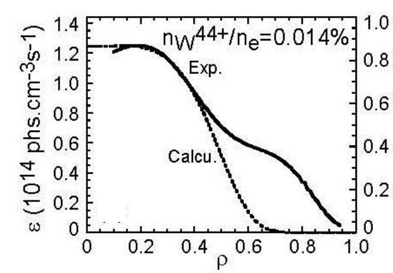

Fig. 3 Radial emissivity profile of W^{44+} line at 6.09nm against normalized minor radius r, fitted by calculation