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Progress of collisional-radiative modeling for tungsten EUV spectra

Content

Spectroscopic modelling for tungsten ions is highly demanded to examine tungsten behavior in fusion plasmas as an impurity to cause high radiation power loss. Collisional-radiative models for highly charged tungsten ions have been constructed by several groups, but models in mid- and low-charged tungsten ions are not well studied yet and measured extreme ultraviolet (EUV) and vacuum ultraviolet spectra are not fully explained by models since atomic structure of such tungsten ions are very complex and the atomic data are not easily calculated. We have developed a collisional-radiative (CR) model for tungsten ions to explain EUV spectra measured in plasma with electron temperature ~1 keV – 2 keV, where continuous two-peak broad structure, so-called unresolved transition array (UTA), is seen at 4.5-7 nm wavelength region [1-3]. The UTA is produced by overlapped numerous lines of 4d-4f and 4p-4d transitions of open 4f- and 4d-shell ions, but any current CR models do not reproduce the UTA well [1-5]. We included recombination processes to the CR models for W^{25+} - W^{39+} ions, but still the models were not enough to reproduce the UTA well, since the width of the first peak at 5nm is narrower and the second peak at 6 nm was still weaker than measured spectra. We have tried to extend the CR model to lower charged tungsten ions in order to reproduce the UTA. We will report the contribution of such lower charged tungsten ions to the spectra at 4.5-7nm region in plasma with electron temperature less than 1 keV.

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