Electron-impact single ionization of tungsten ions

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Tungsten is being considered as a plasma-facing material in magnetically confined fusion devices, such as ITER, because of its low sputtering rate, high temperature characteristics and low tritium absorption. Considerable effort has been made to obtain reliable atomic data to enable identification of reference lines for plasma diagnostics and to reliably estimate radiative cooling rates. A number of publications about electron-impact single ionization (EISI) processes have been published for tungsten. However, reliable EISI data are not available for many tungsten ions. Moreover, the effect of long-lived excited states in low charged ionic stages need to be investigated.

We used the flexible atomic code (FAC) in the distorted-wave approximation method to calculate electron-impact single ionization cross sections for tungsten ions. Contributions from direct ionization (DI) and excitation-autoionization (EA) processes are taken into account. Comparison between the previous experimental measurement results and present calculation show a prominent contribution of metastable states in low charged states such as W^{7+}-W^{8+} ions. We also performed ab initio calculation for other moderate charged ions.

In this report, I will present an overview of our recent progress in EISI for tungsten ions.