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Development of Quantitative Atomic Modeling for Tungsten Transport Study Using LHD Plasma with Tungsten Pellet Injection

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Quantitative tungsten study with reliable atomic modeling is important for successful achievement of ITER and fusion reactors. We have developed tungsten atomic modeling for understanding the tungsten behavior in fusion plasmas. The modeling is applied to the analysis of tungsten spectra observed from currentless plasmas of the Large Helical Device (LHD) with tungsten pellet injection. We found that extreme ultraviolet (EUV) lines of W^{24+} to W^{33+} ions are very sensitive to electron temperature (Te) and useful to examine the tungsten behavior in edge plasmas. 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= 1.4 x 10^{-4} and the total radiation loss is estimated as ~4 MW, of which the value is roughly half the total NBI power.

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