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Tungsten spectroscopy for fusion diagnostics using the Shanghai permament magnet electron beam ion trap

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Using the Shanghai permanent magnet electron beam ion trap, Shanghai-PermEBIT, we have established a program on the spectroscopy of low to medium charge states of Tungsten. The motivation of this program is to provide spectroscopic data for Tungsten of interest to Tokamak fusion plasma diagnostics. Due to thermal and mechanical properties, Tungsten has been chosen as one of the materials which will face to the plasma in the ITER Tokamamk. Unfortunately, for diagnostic purposes, there is very little spectroscopic data for Tungsten in the charge states between W6+ and W28+. The atomic structure for many of the ions in this region is very complicated, and in some cases it is not even possible to easily establish the electronic ground configuration due to a conflict between 4f and 5p orbitals. For both W7+ and W27+ there is some evidence that the ground state is quite simple and, if the predictions are correct, a limited number of forbidden transitions should be observable in the visible spectral region. Accurate measurements of the wavelengths of these lines would give precise values for the ground state fine structures in these ions. These fine structures would in turn be useful for establishing more reliable theoretical models for these complex ions. There are also some previously observed lines from W13+ in the soft X-ray region. These observations indicate there should be a number of lines from close by charge states in the same wavelength region. Similar to the above, accurate wavelength measurements can help to establish good theoretical models for tungsten ions with charge states around 13+. This paper will describe some of our spectroscopic measurements to tackle the above mentioned problems.

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