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Tungsten Spectroscopy for Fusion Plasmas

R. Neu[1], T. Puetterich[1], R. Dux[1], A. Pospieszczyk[2], G. Sergienko[2], ASDEX Upgrade Team[1], TEXTOR Team[2]

[1] *Max-Planck-Institut fuer Plasmaphysik, Boltzmannstr.2, 85748 Garching*
[2] *Institut fuer Plasmaphysik, Forschungszentrum Juelich GmbH, 52425 Juelich*

Rudolf.Neu@ipp.mpg.de

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Tungsten is one of very few candidate materials for plasma facing components in future fusion devices. Until recently, it has received only little attention in fusion experiments because of its deleterious effect on the plasma performance experienced in early fusion devices. However, due to this potential hazard a thorough diagnostic of the W influx into the plasma and the W content in the plasma is of outmost importance. Therefore, investigations have been started at tokamaks and EBITs to provide atomic data for W in high temperature plasmas. Usually the influx of impurities is deduced from the intensity of spectral lines from neutrals or ions in a low ionisation state. For this purpose the appropriate ionisation rates and excitation rates have to be known. At the moment, a WI transition ($^7S - ^7P$) at 400.8 nm is used, but an extension of the method to other lines is under investigation. In the core of present day plasmas ionisation states up to W^{56+} can be reached and in a reactor states up to around W^{68+} will be present. In order to extract information on the local W concentrations over the whole plasma radius atomic data (excitation, ionisation, recombination) for all the charge states up to the maximum ionisation state are necessary. Similarly a high sensitivity has to be achieved since the central W concentrations should stay below 10^{-4}. For an unambiguous identification of the transitions EBIT measurements are of great advantage, but due to the lower electron density compared to fusion plasmas, investigations there are indispensable. The talk will highlight recent experimental and theoretical advances and indicate the needs for further investigations.