Post-ablation evolution of the tungsten VUV/XUV spectra in JET

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Tungsten ablated into JET L-mode non-sawtoothing plasmas is used to investigate the tungsten radiation and spectroscopy at low temperatures (Te < 2 keV), which will provide valuable insights to the behaviour of tungsten radiation in the edge and pedestal regions. In earlier experiments, sawteeth dominated the transport [1] and complicated the analysis.

As tungsten penetrates the plasma from its initial ablation point at the outer midplane, we observe changes in both its spatial distribution and in the shape of the spectral features. The main difficulty of quantifying the tungsten density and radiated power comes from the fact that the observed spectra are emitted from very different ionization stages which form diffuse, broad shapes, difficult to model with any certainty [2]. Work on identifying the contributions from different ionization stages to the overall spectra is on-going [1,3]. Here the evolution of both VUV (15 – 50 nm) and XUV (4 – 7 nm) spectral features is compared with bolometry measurements. The changes are affected by the changing temperature, due to the radiation produced by the ablation, and by the changes in the density of the tungsten ionization stages due to transport and reaction to the changing plasma environment.

To model the tungsten radiation measured from spectroscopy and bolometry, synthetic diagnostics are required which depend upon a plasma transport model, an ionisation balance and the line power coefficients for the total radiation or the individual emission coefficients for spectroscopy. JETTO/SANCO simulations have been carried out to assess the sensitivity of the synthetic diagnostic output to different plasma transport models and to the error associated with the relevant atomic rate coefficients. Quantifying the behaviour of the tungsten radiation in these low temperature, L-mode, plasmas can lead both to the better understanding of the changes in plasma pedestal region and of the tungsten spectra in this region.


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