

Intrinsic impurity composition in helium and hydrogen discharges in Wendelstein 7-X

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Intrinsic impurities in fusion devices serve as an indicator for thermally overloaded in-vessel components, but also constitute an important energy loss channel entering the global energy balance of the confined plasma.

In the Wendelstein 7-X stellarator (W7-X), the impurity composition is constantly monitored by means of the High Efficiency XUV Overview Spectrometer (HEXOS) system. The intensity calibration of the instrument, available over large parts of the covered wavelength range, allows, combined with transport codes such as STRAHL, to estimate the concentration of selected impurities. The transport coefficients employed in the calculations are obtained from the evaluation of laser blow-off experiments that have been performed in various discharge scenarios.

The intrinsic impurity composition (with C and O being the main impurities) and their concentrations are evaluated for W7-X discharges in helium and hydrogen, which showed a significant difference in overall plasma performance. In addition, the daily and the long-term impurity concentration evolution are evaluated particularly with regard to the planned wall boronization in the upcoming operation phase.