

Impurity Transport Studies in the divertor operation of the W7-AS Stellarator

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W7-AS is a low shear, 5-period modular stellarator ($R=2\text{m}$, $a_{\text{eff}} \sim 14\text{ cm}$ for $\iota_a \sim 5/9$), equipped with ten discrete divertor modules. The impurity behaviour in various divertor operating regimes has been investigated.

The effective ion charge, Z_{eff} , was derived by means of bremsstrahlung measurements. For this purpose a two channel microspectrometer (PC card) covering the spectral range from 350-900 nm has been installed on the W7-AS. It allowed to spectrally resolve the plasma radiation integrated along a toroidal line of sight crossing the plasma centre, with a time resolution of up to 7 ms. Its spectral resolution was sufficient to differentiate between line radiation and spectral regions with pure bremsstrahlung. A Bayesian probability theory based experimental data analysis was applied. Additional information on the plasma impurity behaviour in different operating regimes was gained from radial Z_{eff} profiles derived by Abel inversion of bremsstrahlung profiles measured with the interference filter based observation system of the Thomson scattering diagnostic.

Beside pure Normal Confinement (NC) and newly found High Density High Confinement (HDH) discharges, also injection of carbon pellets into the plasma of both discharge types has been investigated. From the temporal behaviour of the Z_{eff} values information about the confinement time of carbon is gained. This information is then compared with the insights of the laser blow-off experiments, which have shown that with the transition into the HDH regime the impurity confinement time drops drastically from several 100 ms to values comparable to the energy confinement time (few 10 ms).

Assuming that carbon represents the only plasma impurity, the determined Z_{eff} values are being compared with relative carbon concentrations measured by the charge exchange spectroscopy diagnostic.