Confinement and transport studies of high-Z impurities injected by Laser Blow-Off technique in electron and ion-root TJ-II stellarator plasmas

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The avoidance of impurity accumulation in present day stellarator devices is a key challenge for the development of steady-state operation scenarios in reactors based on this concept [1]. In the TJ-II stellarator, impurity transport was investigated previously in low-density regimes ($\leq 6\times10^{18}$ m^{-3}) [2, 3], where the radial electric field is positive across the minor radius and the plasma is in the electron-root. However, some limitations were found for heavy impurity (Fe, W) injections into high-density microwave heated plasma regimes in this device, due to the intrinsic limitation of the TJ-II cut-off density (1.3×10^{19} m^{-3}) and to the difficulties in achieving a true density plateau at high densities. These limitations have been partially solved with a better conditioning and more operational control. Here, the behaviour of heavy impurities (Fe, W) injected, using the Laser Blow-Off (LBO) technique, into both electron and ion-root regimes in TJ-II plasmas is investigated. For this, the confinement times of the high-Z impurities are deduced from the decay-times of different radiation signals. In parallel, the radial and temporal evolution of the total radiation is analysed using the STRAHL code [4] to deduce transport coefficients. Finally, since neoclassical transport simulations predict differences in transport for different regimes [5], we compare experimental results with simulations obtained using the `EUTERPE` [6] code used to estimate neoclassical transport, and the `stella` [7] code, which predicts the turbulent counter-part. This is done in order to identify the mechanisms involved in these processes.

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