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W Impurity Poloidal Assymmetries Observed at ASDEX Upgrade Using Soft-X-Ray Tomography Reconstruction

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Many tokamaks are nowadays equipped with metallic walls. The positive effect of such modification compared to the previous carbon walls is a strong reduction of the tokamak wall erosion and tritium retention. But the drawback is a production and potential accumulation of heavy impurities in the plasma core which can cause high radiation losses and even trigger radiative collapses often leading to disruptions. Poloidal inhomogeneities of impurity distribution have a significant impact on radial impurity transport [1]. Understanding of the mechanisms leading to inhomogeneous impurity distribution is thus useful knowledge for the control of heavy impurity transport and hopefully accumulation avoidance. Poloidal asymmetries due to centrifugal effects or/and other sources of an equilibrium poloidal electric field in the core plasma, as those generated by minority Ion Cyclotron Resonance Heating (ICRH), are usually negligible in experimental impurity transport analysis on low-medium Z impurities. Such assumptions are not always valid for medium-high Z impurities. Poloidal asymmetries such as those generated indirectly by minority ICRH heating or Neutral Beam Injection (NBI) have been observed and analyzed, using SXR tomographic reconstructions, during recent ASDEX Upgrade experimental campaigns. Trace injections of tungsten have been triggered by Laser Blow Off (LBO) ablation in different scenarios with fixed plasma current. Scans in NBI and ICRH power (H-minority heating scheme) and deposition location (change in frequency and/or toroidal field) have been performed in order to study their effects on Low Field Side (LFS) - High Field Side (HFS) asymmetries. Analysis of the obtained results is presented, focusing in particular on the effects of each actuator. Centrifugal effects have been recently implemented in the code GKW [2] for the description of turbulent impurity transport. The Hinton Wong neoclassical theory in the presence of rotation, implemented in the NEO code, [3], can describe the impact of rotational effect on neoclassical transport. These new theoretical tools with the RF asymmetries now being implemented allow complete transport modeling of poloidal asymmetries.

[1] F.J. Casson et al, Phys. Plasmas 17, 102305 (2010)
[2] C. Angioni et al, Phys. Plasmas 19, 122311 (2012)
[3] E. Belli et al, Plasma Phys. Cont. Fusion 54 015015 (2012)

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