Modelling of ASDEX Upgrade edge plasma in radiative X-point regime

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In this presentation modeling results of ASDEX Upgrade regimes with radiating X-point are presented. Power load decreasing on divertor is important for the future experimental thermonuclear reactor such as DEMO. In present tokamaks radiating impurity is used for decreasing power load on divertor, which forces a transition to the detachment. However, it will not be enough for DEMO because of huge power heat flux inside the confinement region. For reduction of this flux, radiation of the impurity can be used inside the separatrix above the X-point – X-point radiative regime. Such a regime was observed in experiments on the modern tokamaks such as ASDEX Upgrade and JET, where nitrogen and neon are used as radiating impurity.

In the first part of presentation a series of modelling will be observed, where power of the discharge is changing from 5 to 15 MW, and nitrogen seeding rate is chosen from 2e18 to 1.3e21 s^{-1}. It is demonstrated that after exceeding some nitrogen seeding rate threshold the radiative collapse occurs, and the radiative X-point regime could not be reached. In the second part density of the deuterium and nitrogen ions is fixed on the boundary of computational mesh in the core. In this case radiative X-point is achieved after the achieving a full detachment at the outer target. Huge suppression of radial heat flux inside the separatrix is found, and the most part of the power is radiated in the core; exponential power flux decay is $\lambda_q \approx 3$ *mm*. The appearance of electric potential peak above X-point is mentioned, that is necessary for Pfirsch-Schlüter current flow in this area. The corresponding ExB drift is shown to give the major contribution to the particle flux in the vicinity of the X-point.

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