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P2.1072 Simulation study of the influence on Zeff under different gas puffing location for CFETR phase II

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In the future fusion reactor, power exhaust is one of the most critical issues due to the limit of the heat load onto divertor targets. Because the carbon are not suitable to be used as the first wall material, tungsten divertor is considered as the most appropriate candidate, which implies that impurity seeding is indispensable to mitigate heat load onto the divertor target via radiation. For CFETR phase II [1], whose fusion power is designed to be 1 GW, a large radiation fraction is required to dissipate the heat power entering the scrape-off layer. Therefore, considerable amount of impurities would be seeded into the tokamak. However, to avoid significant degradation of the main plasma, the impurity concentration should be kept at low level. In this work, the influence of the gas puffing location on the effective ion charge Zeff is studied using SOLPS5.0 code package. With the argon impurity and fixed radiation fraction ~ 85%, SOLPS simulations are performed for four different gas puffing schemes: (1) deuterium and impurity mixed gas injected from the outer leg (OL), (2) mixed gas injected from the inner leg (IL), (3) mixed gas injected from the top of main chamber (UP) and (4) deuterium injected from the top while impurity injected from the outer leg (UO). The simulated results are fitted to the Matthews' law [2] to give the relationship between the Zeff with the plasma density, which is considered to provide the boundary condition for further optimization of the performance of the core plasma [3]. For the four gas puffing schemes, it is found that the UO scheme has the best radiative efficiency. Furthermore, the puffing location of recycling impurities has a minor influence compared with the deuterium puffing location.

References

[1] Y.X. Wan et al, Nucl. Fusion 57 (2017) 102009.
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[3] N. Shi et al, Nucl. Fusion 57 (2017) 126046

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