

A possible divertor combined the advantages of supper-X and snowflake for CFETR/DEMO

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Abstract

The experimental and modeling have shown that the advanced snowflake divertor can well mitigate heat flux loading onto target surfaces due to the smaller perpendicular incident angle and larger magnetic expansion compared with conventional divertor [1,2]. But, the large magnetic expansion of snowflake may lead to a serious problem of particle exhaust, which results in the core plasma density out of control. In order to well control particle flux, we propose a possible divertor, which combines the advantages of supper-X[3] and snowflake[4], including long leg, large magnetic expansion, closed contracture and small perpendicular incident angle. In this work, we will employ the authoritative edge plasma code SOLPS-ITER [5] to evaluate the control capacity of particle and heat flux for this divertor. The primarily modeling results from SOLPS-ITER show that the carbon impurity and recycling particles can well be screened in outer divertor region accompanying with a large quantity of radiation loss power. Moreover, the neutral pressure is very high near target region due to the good screening, so that the neutral recycling and impurity particles can be removed by the pumping system. This possible divertor not only can well control heat flux, but also remove the partial impurity and recycling particle to control particle by pumping. Such a divertor may potentially provide a power and particle handling solution for long pulse advanced tokamaks.

Reference

- [1]Zheng G Y, Cai L Z, Duan X R, Xu X Q, Ryutov D D, Cai L J, Liu X, Li J X and Pan Y D 2016 Investigations on the heat flux and impurity for the HL-2M divertor Nucl. Fusion 56 126013
- [2]Chen Z P, Kotschenreuther M, Mahajan S and Gerhardt S 2018 A study of X-divertor in NSTX-U with SOLPS simulations Nucl. Fusion 58 036015
- [3]Rozhansky V, Molchanov P, Veselova I, Voskoboinikov S, Kirk A, Fishpool G, Boerner P, Reiter D and Coster D 2013 Modeling of the edge plasma of MAST Upgrade with a Super-X divertor including drifts and an edge transport barrier Plasma Phys. Control. Fusion 55 035005
- [4]Du H and Zheng G 2019 Predictive modeling of detachment cliff with X-Divertor geometry in HL-2M by SOLPS (submitted to Nucl. Fusion)
- [5]Meier E T, Goldston R J, Kaveeva E G, Makowski M A, Mordijck S, Rozhansky V A, Senichenkov I Y and Voskoboinikov S P 2017 Drifts, currents, and power scrape-off width in SOLPS-ITER modeling of DIII-D Nucl. Mater. Energy 12 973–7

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