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The physical design of EAST lower tungsten divertor by SOLPS modeling

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The divertor target is the most intense plasma-surface interaction area in the tokamak. To keep the lifetime of the device and maintain long pulse discharges, the power load and particle removal control become to be the critical issues. The lower graphite divertor of EAST tokamak is the main limitation to the achievement of further high-power long-pulse discharges [1]. To solve this problem, EAST will upgrade its lower divertor to use tungsten material. In this work, the divertor physical design is presented. The requirements for the design includes: (1) heat flux to the target below 10 MW/m2 to protect the target; (2) Te< 10 eV including the far SOL at the target; (3) W impurity control and particle removal. To this end, the new divertor should have strong power dissipation, impurity screening and particle removal capabilities. By using the 2D edge plasma code SOLPS modeling [2-4], the systematic examination of different target shapes, target angles, the pump locations, have been carried out. The optimized divertor geometry for the EAST discharge configuration is proposed. The particle exhaust, which is of essential importance for long-pulse discharges, is analyzed by the effective particle removal with different particle recycling rate at the pump. To sustain the high power discharges, Ar and Ne seeding to improve the power exhaust, and the corresponding W sputtering and W impurity transport, are studied by the coupling of the DIVIMP [5] and SOLPS. Moreover, the quasi-snowflake is assessed for better understanding of the advanced magnetic configuration application on the heat flux control. These studies can improve the understanding of power and particle exhaust, W sputtering and transport during long pulse high power operations for CFETR.

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