Effects of tungsten divertor baffling on plasma detachment during the high power operation

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The steady-state operation of next-step fusion devices requires both the deposited heat flux density on the divertor target below 10 MW/m^2 and plasma temperature at the target below 5 eV to ensure adequate lifetime. Therefore, it will be essential to achieve highly dissipative or detached divertor conditions for the control of heat flux and erosion in a fusion reactor. One of the most effective methods to promote the achievement of detachment is to improve neutral trapping and impurity screening in the divertor by changing the divertor structure [1]. Previous experiment and modeling works on JET, DIII-D, C-mod and JT-60U studies highlight the importance of the divertor target shape and baffling on the plasma detachment [1-6]. However, some critical questions still remain: (1) most of the previous works were based on carbon-target, it is still unknown that whether it is still feasible for tungsten target? (2) what is the range of input power that the current size tokamaks can operate leveraging the benefits from a closed divertor? These question should be answered during the physical design of the lower tungsten divertor of the Experimental Advanced Superconducting Tokamak (EAST). In this work, the physical design of EAST lower divertor will be presented, and a systematic analysis of the target shape and closure effects on the plasma detachment is carried out by using SOLPS to address these questions.

References

[1] A. Loarte, Plasma Phys. Control. Fusion **43** (2001) R183.
[2] C. F. Sang, P.C. Stangeby et al., PPCF **59** (2017) 025009
[3] C. F. Sang, H. Y. Guo et al., Nucl. Fusion **57** (2017) 056043.
[4] H. Y. Guo, C. F. Sang et al., Nucl. Fusion **57** (2017) 044001
[5] B. Lipschultz et al., Fusion Sci. Technol. **51** (2007) 369.
[6] S. Tsuji et al., J. Nucl. Mater. **220-222** (1995) 400.

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