Effect of carbon and tungsten plasma-facing materials on the divertor/scrape-off layer power flux footprint width*

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The high heat flux load to the divertor target is one of the most severe challenges to the tokamak lifetime. The power flux density depends strongly on the heating power and plasma-wetted areas, and the latter is dominated by the power width \( \lambda_q \). Recent experiments and theory found that \( \lambda_q \) is in inverse proportion to the plasma current, which is of great important for ITER and CFETR. Most of the \( \lambda_q \) studies are based on the carbon machine experiment, our previous work indicated that the plasma-facing materials (PFMs) has a significant impact on the divertor and scrape-off layer plasma due to the particle recycling [1] and intrinsic impurity [2]. All these studies raise us a question, i.e. whether there is correlation between \( \lambda_q \) and PMFs? To this end, the effects of carbon and tungsten PFMs on the power flux footprint width in EAST will be presented by using SOLPS-ITER code package in this work. The simulation result reveals that in the attached condition the effect PFM on the divertor entrance power width \( \lambda_q^{\text{div-ent}} \) is small, but it plays an obvious role on divertor target power width \( \lambda_q^{\text{div-target}} \). The main reasons are that (i) more neutral particles by recycling from C divertor could slightly increase \( \lambda_q^{\text{div-target}} \), (ii) the impurity from target sputtering could significantly enhance \( \lambda_q^{\text{div-target}} \). The simulation indicates that the impurity power radiation and volumetric power loss processes could influence the \( \lambda_q^{\text{div-target}} \) [3]. In addition, the electric drifts (\( E\times B \) and \( B\times\nabla B \)) effects with different PFMs on \( \lambda_q \) are also considered, which could change the particle transport, thus the power flux [4].


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