7th Asia-Pacific Conference on Plasma Physics, 12-17 Nov, 2023 at Port Messe Nagoya

Evaluation of edge transport and core accumulation of tungsten for CFETR with EMC3-EIRENE and STRAHL

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The edge transport and core accumulation of tungsten (W) particles on CFETR have been studied by integrated modelling consisting of EMC3-EIRENE and STRAHL codes [1-2]. The edge transport and power dissipation of W particles are simulated by EMC3-EIRENE. An in-out asymmetry of $W^{(1-28)+}$ ions density has been revealed in the in- and out-board divertor regions. This is mainly due to the stronger reversal flow velocity of W ions at the outboard divertor. The upward flow of W ions near the separatrix leads to a moderate W impurity leakage from the divertor on CFETR compared to the existing full W device ASDEX Upgrade due to the high plasma density near the CFETR divertor targets. Further, the density distribution and radiation loss of W ions in the core region are investigated by STRAHL code. The high charge-state $W^{(29-60)+}$ and $W^{(61-74)+}$ ions mainly reside in the regions of Ψ_N = 0.20~0.98 and 0.00~0.90 (Ψ_N is the normalized poloidal magnetic flux), respectively. The W induced energy dissipation in different regions is assessed according to both STRAHL and EMC3-EIRENE simulations. Particularly, the impacts of the W core radiation on the operation regime are discussed according to the H-mode threshold scaling law proposed by Martin [Martin Y R et al 2008 J. Phys.: Conf. Ser. 123 012033] for the baseline plasma on CFETR. Further, parameter studies on the pinch velocity (v_{imp}) and diffusion coefficient (D_{imp}) have been performed to check their impacts on the operation regime of CFETR. A three-fold increase of v_{imp}/D_{imp} results in a higher W core energy loss, which can lead to the transition from H-mode back to L-mode.

Reference
[1] S.Y. Dai, *et al.*, Nuclear Fusion, 62,036019, (2022).
[2] B. Liu, *et al.*, Nuclear Fusion, 62,126040, (2022).