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Evaluation of tungsten effect on CFETR phase I performance[1]

SHENGYU SHI, University of Science and Tech of China, XIANG JIAN, School of Electrical and Electronic Engineering, Huazhong University of Science and Technology, VINCENT S. CHAN, University of Science and Tech of China, General Atomics, NAN SHI, GUOQIANG LI, XIANG GAO, Institute of Plasma Physics, Chinese Academy of Sciences, CFETR PHYSICS TEAM — An integrated modeling workflow using OMFIT/TGYRO is constructed to evaluate Tungsten (W) impurity effects on China Fusion Engineering Test Reactor (CFETR) performance. Self-consistent modeling of W core density profile, accounting for both turbulence and neoclassical transport contribution, is performed based on the CFETR steady-state scenario developed by D.Zhao (ZhaoDeng, APS, 2016). It's found that the fusion performance degraded in a limited level with increasing W concentration. The main challenge arises in sustainment of H-mode with significant W radiation. Assuming the power threshold of H-L back transition is approximately the same as that of L-H transition; it is found that the W concentration is not allowed to exceed 3e-5 to stay in H-mode for CFETR phase I according to the scaling law found by Takizuka (Takizuka etc, Plasma Phys. Control Fusion, 2004). In addition, it's found that the tolerance of W concentration decreases with increasing pedestal density by trade-off study of pedestal density and temperature. A future step is to connect this requirement to W wall erosion modeling.

[1]CFETR Physical Group

Yu Shi
University of Science and Tech of China

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