Effect of ICRF on tungsten impurity behavior in EAST H-mode discharge

Zhen Zhou[1,2*], Shengyu Shi[2], Ling Zhang[2], Tao Zhang[2], Xiaohe Wu[1,2], Yunxin Cheng[2], Xiang Jian[2], Kaixuan Ye[2], Lin Yu[2], Ziqiang Zhou[1,2], Jiuyang Ma[1,2], Shuqi Yang[1,2], Kangning Geng[2], Gongshun Li[2], Jia Huang[2], Fei Wen[2], Yunfeng Liang[3], Xiang Gao[2]

[1] University of Science and Technology of China, Hefei 230026, China
[2] Institute of Plasma Physics, Chinese Academy of Sciences, Hefei 230031, China
[3] Forschungszentrum Julich GmbH, Institute of Energy and Climate Research-Plasma Physics (IEK-4), Germany

*Presenting author: zhen.zhou@ipp.ac.cn

Abstract

The accumulation of tungsten impurity in the core region will deteriorate the plasma performance, even further to radiative collapse [1,2]. The inward neoclassical convection can be enhanced by the density peaking and large toroidal rotation generated by NBI [3-5]. The peak electron temperature produced by ECRH and LHW can enhance turbulent diffusion and alleviate the tungsten accumulation in the core [6]. In the recent experiments, the intensity of tungsten unresolved transition array (W-UTA) decreased by ~20% with the higher ICRH power (from 1.7MW to 2.6MW) was observed in a high power injection (P_{inj}>10MW), high performance (β_N~2, β_P~2.8, n_e/n_{GW}~80%, f_{BS}~60%, I_P~400kA) H-mode discharge with Li-coated walls on EAST. However, unfortunately, tungsten control by ICRF is difficult to be reproduced in a similar discharge under metal wall without Li coating, where the W content can be significantly increased. In contrast to the effects of NBI and ECRH on tungsten impurity transport, the toroidal rotation of the plasma decreased by ~10 km/s, the electron density increased slightly, a lower level of total radiation power in plasma core and no significantly change in the temperature profile after ICRF injection. Based on the EUV spectroscopy measurement, the particle influx of low-Z impurity (Li^{2+}, C^{2+}) was found to increase by ~100% while that of high-Z impurity (Fe^{4+}) didn't change significantly after ICRF injection. Furthermore, an obvious out-in poloidal asymmetry of radiation distribution was found from reconstructed of radiation distribution. And the particle flux and electron temperature at inner divertor region significantly decrease suggesting the occurrence of detachment during the ICRF injection. A typical discharge is then used for simulation by TGYRO. The experiment result and simulation analyze are summarized and discussed in this work.

References

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Selected Topic 5: " Impact of a W transport on H-mode plasmas: experiments and modelling "