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Studies of The ICRH Antenna coupling on EAST

X.J. Zhang[1, a)], Y. Cheng[1, b)], C.M. Qin[1], J.H. Zhang[1,2], Y.P. Zhao[1], Y.Z. Mao[1], S. Yuan[1], L. Wang[1], S.Q. Ju[1], G. Chen[1], B.N. Wan[1], X.Z. Gong[1], J.P. Qian[1], T. Zhang[1], J.G. Li[1], Y.T. Song[1], Y.Q. Yang[1,2,] Z. Chen[1,2], J.H. Wang[1,2] Y. Lin[3], G. Taylor[4], S. Wukitch[3], J.M. Noterdaeme[5,6], J.C. Hosea[4], R. Kumazawa[7], T. Seki[7], K. Saito[7] and H. Kasahara[7]

[1]Institute of Plasma Physics, Chinese Academy of Sciences, Hefei 230031, People's Republic of China
[2]University of Science and Technology of China, Hefei 230026, People's Republic of China
[3]MIT Plasma Science and Fusion Center, Cambridge, MA 02139, USA
[4]Princeton Plasma Physics Laboratory, Princeton, NJ 08543, USA
[5]Max-Planck Institute for Plasma Physics, D-85748, Garching, Germany
[6]EESA Department, University of Gent, B-9000 Gent, Belgium
[7]National Institute for Fusion Science, Toki, 509-5292 Japan

a) Email: xjzhang@ipp.ac.cn
b) Email: chengy@ipp.ac.cn

Abstract:

The performance of the ion cyclotron range of frequencies (ICRF) Heating system depends on the coupling capabilities of the antenna to the inhomogeneous plasma profile in front of it. The experiments were carried out to study the coupling characteristics of the ICRF antenna on EAST. The aim of this study is to improve the coupling of the ICRF antenna on EAST. The experimental coupling resistance is compared with the calculation results which come from the upgraded antenna coupling code based on the variational theory. Rough agreements between the experimental coupling resistance and calculation results are obtained. Either reducing the gap between the limiter and the LCFS or increasing the plasma density can enhance the coupling resistance of the antenna with dipole phasing by adjusting the position of the cutoff density on the low-field-side. Altering the antenna phasing from spectra of higher parallel wave number to spectra of lower parallel wave number can also improve the coupling efficiency significantly regardless of the heating efficiency. During the gas injection experiments, the coupling resistance increases beyond 35% with the gas injection rate of 3.5×10^{20}/s compared with the resistance without the gas injection. The coupling resistance decreases sharply at the L-H transition and there are positive spikes of the coupling resistance caused by ELMs that have a bad effect on the stability of the ICRF system. However, it is notable that the presence of the LHW can improve the ICRF antenna coupling efficiency during the H-mode by modifying the density profile in the SOL. The speculation that the LHW modifies the density profile in front of the ICRF antenna by changing the behavior of the ELMs needs to be confirmed in the future.