Experimental Study on Pedestal Fluctuations in H-modes without Large ELMs during the Transition to A Detached Tungsten Divertor at EAST

R. Chen(*chenran@ipp.ac.cn*)[1], Y. Ye[2], G.S. Xu[1] and L. Wang[1]

[1]*Institute of Plasma Physics, Hefei Institutes of Physical Science, Chinese Academy of Sciences, P. O. Box 1126, Hefei 230031, People's Republic of China*

[2]*Institute of Energy, Hefei Comprehensive National Science Center, Hefei 230031, China*

Studying on the pedestal fluctuations in small/no ELM H-modes may provide important insights into sustainment of large ELM elimination when compatible with a radiative divertor. H-mode operation without large edge-localized modes has been achieved in EAST with an ITER-like tungsten divertor, while being compatible with the partial and pronounced detachment in divertor, via either ramping-up of bulk density or injection of low/high-Z impurities. The pedestal characteristics during the transition from the attached to the detached divertor and the reversed transition (detached to attached) under different detachment methods are studied in detail, where the evolutions of multi fluctuating structures commonly residing in the H-mode pedestal of EAST (edge coherent mode (ECM) [1], magnetic coherent mode (MCM) [2] and high frequency mode (HFM) [3]) are highlighted. It is found that in the pronounced detachment which EAST has successfully achieved at the auxiliary heating power P_{source} = 2–6 MW, the ECM tends to disappear either by ramping plasma density up or by impurity injection in the divertor, while evolutions of the MCM and the HFM behaviours are not uniform. Further analysis shows that, in addition to the pressure gradient which is considered as a primary free energy source for the pedestal instabilities including the ECM, the MCM and the HFM, the pedestal collisionality also appears to play a crucial role in affecting the ECM amplitude, and subsequently influencing the MCM and the HFM intensities possibly via re-allocating free energy among the three modes. In addition, the radial structures of ECM, MCM and HFM are compared, for the first time, in one discharge.

References

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