SVI-4

ELM 制御の課題：金属壁・ダイバータにおける周辺プラズマ特性

Edge plasma characteristics in metal wall/diveror

浦野創 （日本原子力研究開発機構）
Hajime URANO (Japan Atomic Energy Agency)

The H-mode pedestal confinement can strongly be affected by the choice of first wall materials through plasma impurity composition and measures required to prevent first wall damage. Recently, the influence of the wall materials on the ELMy H-mode regime has intensively been studied in accordance with an issue of the potential tungsten divertor in ITER. The ASDEX Upgrade carbon wall was replaced by a DEMO-relevant full W-wall and divertor [1], whereas in JET the carbon wall was fully replaced by an ITER-like Be main chamber first wall and W divertor (ILW) [2].

In these devices, a common pattern in full metal devices has been found that the pedestal and global confinement are affected by a requirement for increased gas fuelling (to screen high-Z impurities influxes) as well as a change in pedestal stability due to a decrease of the low-Z impurity concentration in the pedestal region. Basically, the requirement for strong gas puff leads to the conventional confinement degradation that has generally been seen at high densities. Under such a high density operartion in the metal wall devices, the ELM frequency tends to become significantly higher while the ELM released energy becomes smaller. In addition to this density-originated confinement degradation, a further reduction in the pedestal confinement by $\sim 30\%$ was observed at high triangularity in the ILW experiments. This reduction in the pedestal pressure can be overcome by seeding low-Z extrinsic impurities. However, the role of low-Z impurity has not yet been known clearly. Comparison with the effect of low-Z impurity seeding on the pedestal characteristics in other carbon wall devices is an important topic in order to obtain an unified physics understanding of the role of impurity. In ASDEX Upgrade, the L to H-mode threshold power was reduced obviously just after the full W-wall and divertor were settled, while there was no clear difference observed during the period of partially carbon and W wall. The absence of carbon can thus affect the L to H-mode transition. The underlying physics mechanism is still under investigation and requires further understanding of the role of impurities on the pedestal stability and pedestal structure formation.

Reference

[1] R. Neu et al., Phys. Scr. (2009) 014038.
[2] G. Matthews et al, Physica Scripta, T128 (2007) 137.