

Heat Load Measurement with a Movable Limiter in Non-Inductive Current Driven Plasma Maintaining with a Microwave of 8.2GHz on QUEST

Natsuhiko Hamada¹, Kazuaki Hanada², Hideki Zushi², Kazuo Nakamura², Hiroshi Idei²,
Makoto Hasegawa², Akihide Fujisawa², Yoshihiko Nagashima²

(Please put every name of co-author.)

¹*IGSES Kyushu Univ., Kasuga, Fukuoka, 816-8580, Japan*

²*RIAM, Kyushu Univ., Kasuga, Fukuoka, 816-8580, Japan*

To find how to reduce huge heat load on plasma facing components (PFCs) in future fusion power plants down to a reasonable level is one of the most important research issues, and the heat load is easy to be measured in plasmas with high power and/or long duration. QUEST, a spherical tokamak with a middle size ($R = 0.64$ m, $a = 0.4$ m, $B_T < 0.25$ T, a microwave power of $8.2 \text{ GHz} < 400 \text{ kW}$) is focusing on the researches of steady state operation and have already researched on its heat load distribution in various magnetic configurations with increment of cooling water temperature of PFCs [1]. The results show that 20 - 30 % of the injected microwave power was delivered to a movable limiter located nearby the surface of the vacuum vessel in the low field side, and it did not depend on the magnetic configuration so much. So, it seemed that the heat load to the movable limiter mainly provided with energetic electrons trapping in outer side of the last closed flux surface (LCFS).

To confirm the origin of the local heat load to the movable limiter, we tried to move position of the movable limiter by +25 mm (+10 mm - +25 mm from the surface of the fixed limiter. The signs of + and - mean the plasma and the vessel sides, respectively.), and it finds that the heat load moves to those on several fixed limiters located on the surface of the vessel and the total amount of the heat load was kept almost constant. The radial width of the heat load is about 10 mm even when the position of the movable limiter was far from the LCFS by more than 40 cm. Moreover a floating potential measurement of the movable limiter shows large negative values like several kVs were always observed when the significant heat load was coming. This means that some of energetic electrons are present even in outer side of the LCFS. The detail orbit calculation for such a trapped energetic electron should be done to further understanding.

[1] Kazuaki Hanada *et. al.*, plasma and fusion science, in printing (2014)