ICRF mode conversion heating and long-pulse discharges in LHD

K. Saito, T. Mutoh, R. Kumazawa, T. Seki, Y. Nakamura,
N. Ashikawa, K. Sato, M. Shoji, S. Masuzaki, H. Ogawa[a],
H. Takeuchi[b], H. Kasahara, F. Shimpo, G. Nomura, M. Yokota,
C. Takahashi, A. Komori, and the LHD Experimental Group
National Institute for Fusion Science, Toki, Japan.
[a]*Graduate University for Advanced Studies, Hayama, Japan.*
[b]*Nagoya University, Nagoya , Japan.*

In LHD long-pulse discharge was conducted by ICRF minority ion heating. Plasma was sustained for 525 seconds with the heating power of 1.1MW supported by ECH and NBI. However, two types of plasma collapse were often observed. One was gradual density increase up to the density limit by the local heat load on divertor plates. The other was sudden radiation power increase due to the influx of Fe.

Another approach to steady-state operation is electron heating that does not accelerate ions. ICRF heating by use of mode conversion from fast wave to ion Bernstein wave was applied to long-pulse discharge in LHD. Experiment was conducted by using helium and hydrogen. Fundamental cyclotron resonance layer of hydrogen located in the peripheral resign of plasma. The injected RF power is mainly absorbed by electrons not by ions [1]. By this heating method with the power of 260kW from two ICRF antennas, plasma was sustained for 90 seconds supported by ECH (100kW). Temperature distribution on divertor plates was less localized than that of minority ion heating. Therefore, ICRF mode conversion heating can be useful for high-power steady-state operation.

[1] K. Saito, et al., Nucl. Fusion 41 (2001) 1021.