

## §8. ECH Plasma Experiments of Levitated Internal Coil Device Mini-RT

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ECH plasma experiments of magnetically levitated internal coil device Mini-RT have been carried out. Internal coil device Mini-RT has novelty of system technology that is not seen in traditional devices, for using high temperature superconducting wire (Bi-2223) in the internal coil. In Mini-RT device, the internal coil placed in the vacuum chamber is cooled until 20K by low temperature helium gas through detachable transfer tubes. Coil current is induced by external power supply through inserted detachable electrode, and moved into persistent current mode by turn on the permanent current switch (molybdenum additive Bi-2223 wire) set in the internal coil. The internal coil with persistent current is lifted up to the center of the vacuum chamber and levitated magnetically with the levitation coil on the vacuum chamber. In past experiments, the internal coil was cooled until 20K within about 11 hours and excited until it reached the rated current (50kAT). In addition, the internal coil was successfully levitated for about 1 hour with positioning accuracy less than  $20\ \mu\text{m}$ .

While, plasma experiment started first with the state that the internal coil is supported. Plasma production and heating experiments by ECRH with 2.45 GHz microwave source (maximum input power is 2.8kW) have been carried out. Double and triple probes and visible spectroscopy have been used for measurement of plasma parameters. Radial profile of electron density and temperature measured by probes have peak at the position that 3-4 cm from the surface of the internal coil, as shown in Fig.1. Electron density measured by probes is close to the cut-off density for 2.45GHz microwave ( $7.6 \times 10^{16}\text{m}^{-3}$ ). The electron temperature is 10-20eV, and seems to be uniform. And ion

temperature measured by Doppler shift is about 1eV. At the present time, plasma can be produced under the condition that back pressure of a natural gas is relative high ( $\sim 0.03\text{Pa}$ ). These results may be caused by the fact that the support structure exists within the last closed flux surface.

Recently plasma production experiment at the condition that the internal coil is levitated was carried out. In the experiment, it is affirmed that position control of the internal coil can be operated with plasma. Figure 2 shows the plasma produced around the floating coil, and the separatrix configuration at the upper region of the torus can be seen. More detailed measurement of plasma with the floating internal coil is scheduled in the near future.

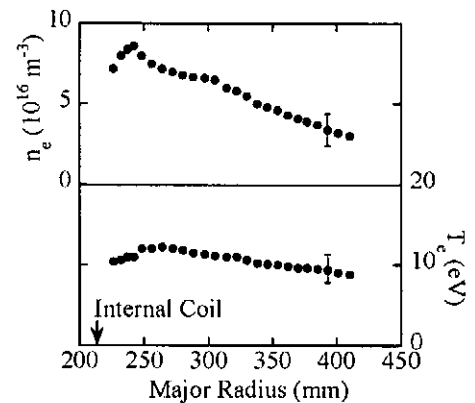


Fig.1 radial profile of Mini-RT plasma at the condition that the HTS coil is supported (measured by triple probe).



Fig.2 Plasma produced by 2.45 GHz microwave at the condition that the internal coil is floating.

[1] Y. Ogawa *et al.*, J. Plasma Fusion Res., **79** (2003) 643.