

§6. Rf Power Performances for Ring Shaped and New Parallel Rod Multi-antenna Systems of Rf Ion Source

Shoji, T. (Dept. Energy Eng. And Sci., Nagoya Univ.)
Oka, Y.

As a filament less system, rf ion sources have several advantages, such as easy maintenance, long operation time, less contamination from the filament metals etc. However, high beam current and large diameter beam are necessary to be developed for the practical NBI source for the fusion research. We have been developing the multi-antenna rf ion source for these purposes¹⁻³⁾. The ring shaped rf antennas were exchanged to the new rod shaped one designed for the higher power operation.

The old ring shaped antenna elements (Fig.1 (b)) are made of copper rods and placed in ceramic pipes to avoid taking the net electron current from the plasma, which raise the plasma potential. The new antenna (Fig.1 (c)) is designed to reduce the antenna inductance, increase a breakdown voltage and improve density uniformity. The antenna consists of four parallel copper pipes (6φ, 200mm long) inserted into 20φ quartz tubes. The antennas are installed in 35 cm x 35 cm x 18 cm rectangular multicusp plasma chamber and are connected electrically outside the chamber as shown in Fig.1(a).

The maximum rf power is 50kW and frequency is 9MHz. The ion saturation current I_{ion} is measured by Langmuir probe. Preliminary result of rf power dependence on I_{ion} for old and new parallel antenna system is shown in Fig. 2. The number of parallel antenna segments is four in both cases. I_{ion} for the old antenna jumps around 10kW and rf breakdown occurs at ~15kW. The new antenna does not show any break down below 40kW and creates high ion current. Further investigation of the plasma characteristics produced by the new antenna is now underway.

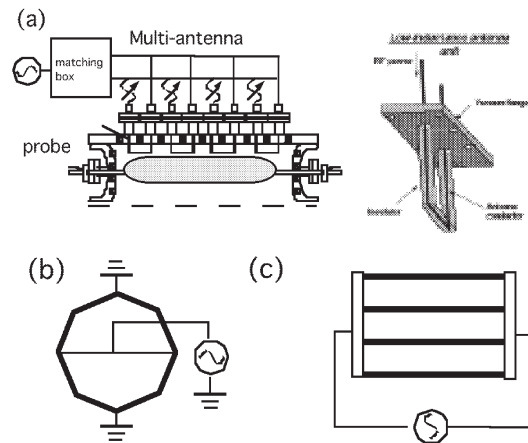


Fig. 1 (a) Multi-antenna RF ion source and segmented antennas, (b) old segmented loop antenna system and (c) new 4 parallel antennas.

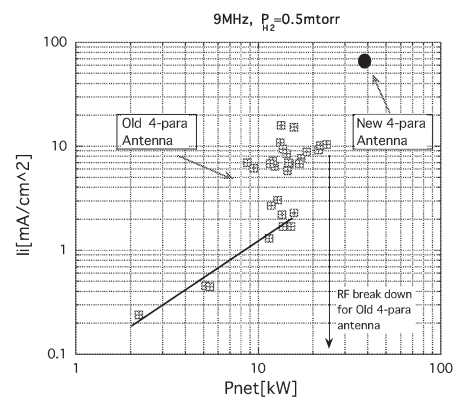


Fig. 2 Ion saturation current at the center of bucket chamber as a function of rf input power for old ring shaped and new parallel antenna systems. rf frequency is 9MHz. Hydrogen pressure is 0.5mtorr.

Reference

- 1) Shoji, T, Sakawa, Y, Hamabe, M and Oka, Y., Ann. Rev, NIFS, (2001) 141
- 2) Y. Oka, T. Shoji, in 5th JA-EU Workshop on NBIs (Super JDC), Sept. 18, 2000, CIEMAT Madrid.
- 3) Y. Oka, T. Shoji, et al, 10th ICIS2003, Sep.2003, Dubna, Russia