§8. Efficiency of ICRF Minority Heating in the CHS Plasma[1]

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For the study of the ICRF minority heating in non-axisymmetric configurations we have developed the orbit following Monte Carlo simulation code[2]. In our code, finite beta effects, complicated orbits of high energy particles, Coulomb collisions, and interaction between the particles and applied wave are included. In this paper we have studied the ICRF minority heating in the plasma of the Compact Helical System (CHS).

In the present calculations we consider two different configurations of CHS; one is the configuration with the major radius position $R = 0.921$m and the other is $R = 0.888$m.

Fig. 1 shows the plots of the heating efficiencies, η, defined by P_{trans}/P_{abs} as a function of the absorption power by minority ions, P_{abs}, in the case of $R = 0.921$m where $n_0 = 3.0 \times 10^{19}$m^{-3}, $T_0 = 150$eV, and $H/(D + H) = 0.10$. We change the strength of magnetic field; $B = 2.0$T(open circles), 1.4T(open squares) and 0.92T(open triangles). In both cases the decrease of the heating efficiency can be seen with increase of P_{abs} and higher efficiencies are obtained in the stronger magnetic field. This indicates that the heating efficiency strongly depend on the strength of magnetic field. Comparing the results of the two configuration cases it is found that the heating efficiency of $R = 0.888$m case is higher than that of $R = 0.921$m in all cases of magnetic field strength.

To clarify the dependence of the heating efficiency on the strength and configuration of the magnetic field we consider a fitting function given by $\eta = 1/(1+P_{abs}/P_0)$, where P_0 is an adjustable parameter and also gives the value of P_{abs} at $\eta = 0.5$. Fig. 2 shows the values of P_0 in the two configu-

rations as a function of the magnetic field strength. The strong dependency of P_0 on the magnetic field strength can be seen. The relation $P_0 = \alpha B^\gamma$ can fit the calculated data if we chose $\alpha = 135.3$ and $\gamma = 1.28$ in the case of $R = 0.888$m, and $\alpha = 67.8$ and $\gamma = 1.14$ in the case of $R = 0.921$m. The larger value of α shows the better efficiency in the case of $R = 0.888$m and the value of $\gamma \sim 1.2$ shows the strong dependence of the heating efficiency on the magnetic field strength in both cases.
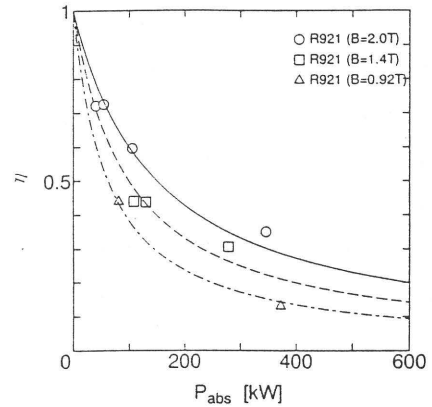

Fig. 1: *Plots of the heating efficiency, η, versus the absorption power by minority ions, P_{abs} in the CHS plasma ($R = 0.921$m).*
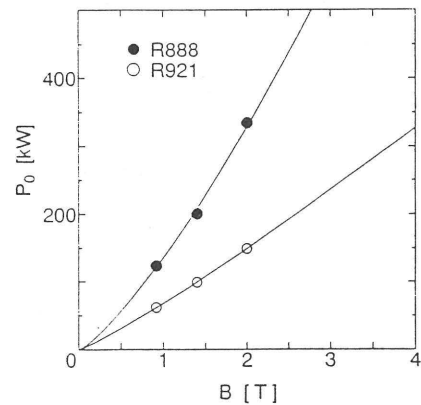

Fig. 2: *Plots of P_0 as a function of magnetic field strength, B.*

References

1) Murakami, S., et al., to be published in Fusion Engineering and Design (1994)

2) Murakami, S., et al., to be published in Nuclear Fusion **33** (1994)