§27. Particle Confinement Time of NBI Plasmas in CHS

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Particle confinement time τ_p was obtained from measurements of poloidal and toroidal distributions of Hα and Lyman α emissions in CHS [1]. A toroidal Hα array is periodically set at 8 toroidal locations (45deg. each). Two poloidal distributions of hydrogen emissions are obtained from horizontally and vertically elongated positions of the elliptical plasma. The horizontal profile is measured with an 11 channel Hα array and the vertical profile is obtained with Lyman α using a rotating octagonal mirror VUV spectrometer system.

The plasma-wall distance in CHS is little because of the low-aspect ratio. In case of inward-shifted plasmas (R_{ax}<97.4cm) the LCFS is determined by the inner wall of the vacuum vessel (limiter-dominated configuration). In case of outward-shifted plasmas a small space appears between the inner wall and the LCFS, typically 1cm for R_{ax}=99.5cm and 4cm for R_{ax}= 101.6cm (divertor-dominated configuration). The particle influx rate of the wall limiter Γ_{lim} to the total influx rate Γ_{tot} is obtained in Fig.1.

A typical result of the τ_p is shown in Fig.2 for Ti-gettered NBI discharges at R_{ax}=92.1cm. The τ_p increases with increasing n_e. The τ_p takes a maximum value of 5ms at a line density of 5.4×10^{13}cm^{-3}. The stored energy W_p is also a strong function of n_e and both of them have each peak value at 5.4×10^{13}cm^{-3}.

The global recycling coefficient R was analyzed as shown in Fig.3. It is understood that the recycling is very different for limiter- and divertor-dominated plasmas. The data indicate that the recycling coefficient is a strong function of n_e and in the case of divertor-dominated configurations the R has large values even in the low-density range.

The τ_p obtained is compared with τ_E as shown in Fig.4. It is found that the τ_p has a linear relation to the τ_E normalized to $P^{-0.58}$, where the LHD scaling is used as an expression of the power degradation term. This means that the τ_p is constant for the input power, in addition to the fact that the τ_p has to be improved for the improvement of τ_E.

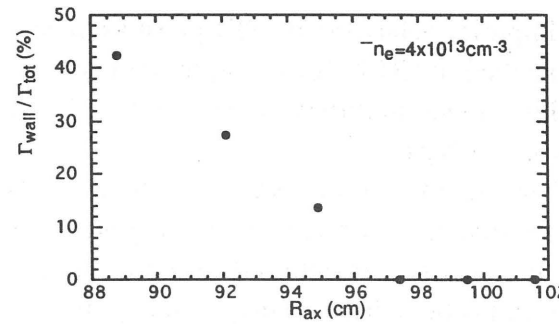

Fig.1 $\Gamma_{limiter}/\Gamma_{total}$ as a function of n_e.

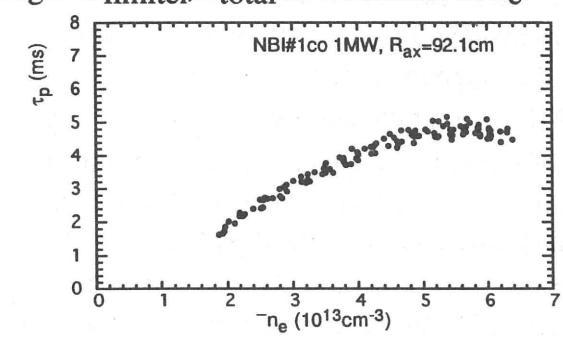

Fig.2 τ_p as a function of n_e.

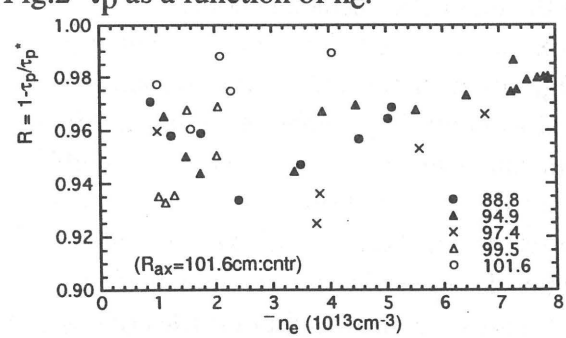

Fig.3 Global recycling coefficient R.

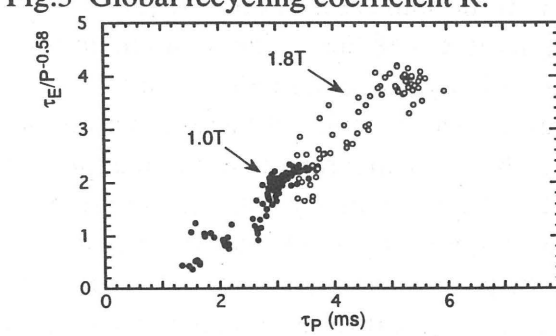

Fig.4 Relation between $\tau_E/P^{-0.58}$ and τ_p.

Reference
1) Morita,S., Yamada,H., *et al.*, Fusion Tech. 27 (1995) 239.