§8. Dependence of Magnetic Field Structure on Formation of N-ITB

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The neoclassical particle flux is considerably affected by the magnetic field structure in the helical plasma. Accordingly, the shift of the magnetic axis affects the radial electric field , then the formation of the N-ITB. The experiments are performed for EC heated NBI plasma, the parameters for the produced plasma are $B_T = 0.88T, P_{inj}^{NBI} \sim 500kW, P_{inj}^{ECH}$, and $\sim 160kW$. The location of the magnetic axis discussed here are 89.9, 94.9, and 97.4 cm. The previous results for 92.1 cm are also plotted as open circles.

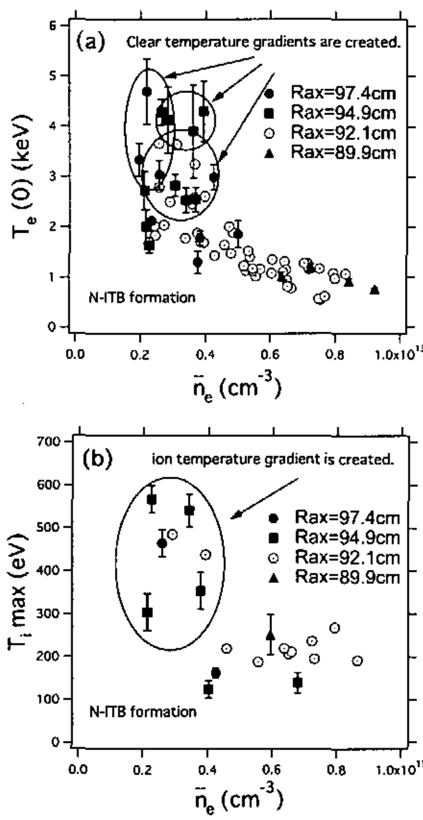

Fig. 1: **Dependence of electron (a) and ion (b) temperatures on magnetic axis location as a function of averaged density.**

The electron and ion temperatures are plotted as a function of line averaged density as shown in figure 1 (a) (b), because the characteristic of the forming N-ITB depends on the plasma density. These plots clearly show the difference of the temperature for the various magnetic axis location on the same density. In figure 1(a), the closed circles and squares denote the central electron temperature when the magnetic axis is located at 97.4 cm and 94.9 cm, respectively. The 92.1 cm results that is denoted by the open circles correspond to the previous EC heated NBI experiments. The N-ITB has been formed when the density is below the threshold ($4 \times 10^{12} cm^{-3}$). The achieved electron temperatures ($\sim 4keV$ at $n_e \sim 3 \times 10^{12} cm^{-3}$) of 94.9 cm are higher than those of 92.1 cm in the particular density range ($2.2 \times 10^{12} cm^{-3} < n_e < 4.2 \times 10^{12} cm^{-3}$) and the sharp temperature gradient is created. The temperature gradient is caused by the reduction of the electron thermal transport from the N-ITB formation. In contrast, the electron temperature of 97.4 cm is lower than that of 94.9 cm and the formation of the electron temperature gradient is not clear. However, in the lower density ($n_e \sim 2 \times 10^{12} cm^{-3}$), the electron temperature increases up to $\sim 4keV$ and the sharp electron temperature gradient is created.

In EC heated NBI plasma, the ion neoclassical internal transport barrier with the reduction of the ion thermal diffusivity has been also observed. For the magnetic axis shift experiment, the same characteristics are observed for the ion temperature as electron temperature, as shown in figure 1 (b). The highest ion temperature is achieved when the magnetic axis is located at 94.9 cm. The ion temperature at 97.4 cm goes up to $\sim 450eV$ below $n_e \sim 2 \times 10^{12} cm^{-3}$. We can not find the transition to the N-ITB when the magnetic axis is located at 89.9 cm, because the plasma is kept at the higher density caused by the attachment of the plasma to the inner wall. It is noted that there is not one to one correspondence between the ion and electron data because the CXS measurements are averaged during 20 ms.