§10. Pedestal Structure during the High Density Edge Transport Barrier on CHS

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As is previously reported[1], a reheat mode and an edge transport barrier (ETB) are simultaneously realized on CHS. The reheat mode is initiated by shutting off fueling with stopping gas-puff. The electron temperature in the peripheral region is raised up, thus the thermal transport was improved by the reheat mode. When the ETB is formed, the edge plasma density gradient increases, consequently, the particle transport is mainly improved by the ETB formation. To investigate the transport characteristic of the ETB plasma during the reheat mode, the detailed structure of the edge profile is measured with the YAG Thomson scattering system. Figure 1 shows a typical global behavior of ETB plasma during reheat mode. Figure 2 shows density, temperature, and pressure profiles for the typical discharge with the ETB formation during the reheat mode, respectively.

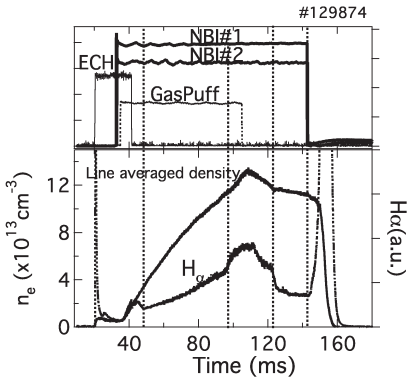

Fig. 1: Global behavior of ETB plasma during reheat mode: line average density and H_α signal are plotted with the injection timings of NBI and ECH heatings.

The electron temperature and density continues to decrease during the first 10 ms from the timing of the gas-puff stop. However, the electron temperature and the pressure increases inversely by the reheat mode from 110 ms, although the electron density continues to decrease. The increase of the plasma temperature is observed in the region ($\rho > 0.6$), and the inflection point in the temperature profile is observed at $\rho \sim 0.5$, as is shown in figure 2 (b). From the onset (123 ms) of the ETB formation, the reduction of the density is suppressed and the profile shape is maintained during the ETB formation. This shows that the diffusion of the peripheral density is blocked by the transport barrier that is created at the edge region. On the contrary, the electron temperature continues to increase by the reheat mode in the outer region of $\rho > 0.5$. Consequently, the peripheral plasma pressure and the pressure gradient becomes larger than that of the ETB alone. The plasma pressure in the edge region at 140 ms becomes three times larger than that at 120 ms, which is the start time of the reheat mode. Therefore, the increase of the plasma stored energy is caused by the increase of the plasma pressure in the edge region. It is noted that the clear pedestal structure is formed in the pressure profile by the simultaneous realization of both the reheat and the ETB modes.

In conclusion, when both confinement improvements are realized, the thermal transport and the particle transports are simultaneously improved in the edge region.

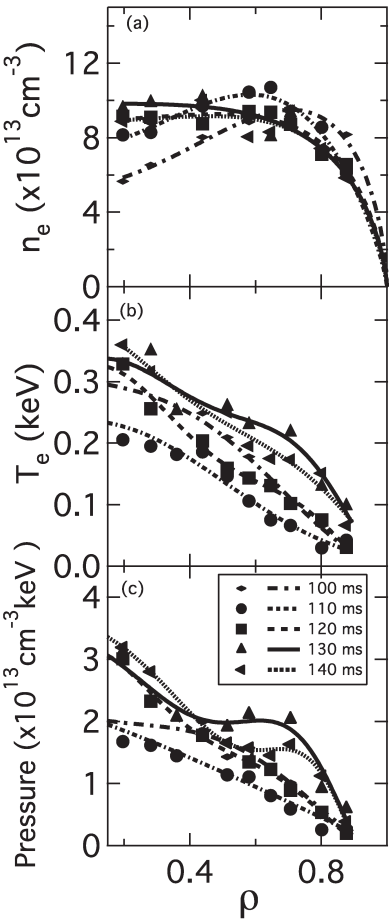

Fig. 2: Density (a), Temperature (b) and pressure (c) profiles of ETB during reheat mode at 100 ms, 110 ms. 120 ms, 130 ms, and 140 ms.

Reference

[1] T.minami, et.al., Plasma and Fusion Research Vol.1, **047** (2006)