Power Threshold for L-H Transition of High Density Edge Transport Barrier with Reheat Mode on CHS

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A new improved confinement mode by a simultaneous realization of both a reheat mode and an edge transport barrier (ETB) is observed in the Compact Helical System (CHS). The normal ETB of CHS is observed for the limiter-plasma heated with two co-injected neutral beams. The ETB has clear spontaneous drop of H_α emission followed by the increase of the stored energy and the H-factor at the L-H transition. However, the factor decreases 10-20 ms after the transition though the H_α drop is maintained. The reheat mode is initiated by shutting off fueling by stopping the gas-puff, and the electron temperature in the peripheral region is increased resulting from the suppression of neutral particle density which causes charge exchange loss. However, the peripheral density continues to decrease after the gas-puff is stopped. In contrast, when both the reheat mode and the ETB are simultaneously realized, the density reduction is suppressed by the ETB in the peripheral region, and the temperature continues to increase due to the improvement by the reheat mode. Consequently, the peripheral plasma pressure and the pressure gradient becomes larger than that of the ETB alone. The enhanced confinement is realized in the high density region ($\bar{n_e} \sim 1.2 \times 10^{20} m^{-3}$), and the stored energy increased up to $\sim$ 9.4kJ. The power threshold for the L-H transition of this new mode was investigated. The results show that the power threshold of the ETB during the reheat mode is almost comparable to the normal ETB taking into account the density dependence of $n_e^{0.4}$ on the threshold.