§4. Comparison of Achieved Temperature between H Dominant and He Dominant Plasmas Produced by High Power ECRH

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In the 18th experimental campaign of the LHD, Various characteristics of the plasma depending on the H/He ratio were intensively investigated toward upcoming deuterium experiment. In the high T_e experiment, the achieved temperature was also compared between H dominant and He dominant plasmas.

We successfully obtained the comparable plasmas with almost same line-averaged n_e and different H/He ratio. Figure 1 shows the radial profiles of (a) T_e, (b) n_e, (c) T_i, and (d) the scale length of the ion temperature gradient R_{ax}/L_{Ti} for the H dominant ($n_H/(n_H+n_{He})$ = 0.94, #126515) and the He dominant plasma (($n_H/(n_H+n_{He})$ = 0.18, #127380) with moderate higher line-averaged n_e of ~2.4x10^{19} m^{-3}. A smoothed curve of $T_i = c_1+c_2x^2+c_3x^4+c_4x^6+c_5x^8$, which is illustrated in Fig.1 (c) was used for the evaluation of R_{ax}/L_{Ti}, where x corresponds to r_{eff}/a_{99} and c_1–c_5 are fitting parameters. The operation was carried out using high power ECRH and a diagnostic NBI under the magnetic configuration of R_{ax} = 3.6 m/ B_t = 2.705 T. In both discharges, the improvement of the electron thermal transport in the plasma core region was observed due to the formation of the electron ITB and the n_e profile showed the hollow shape. There was slight difference in the T_e profiles, namely T_e in the core region was higher for the H dominant case and that in the edge region was higher for the He dominant case. This is considered due to the difference in the shape of n_e profile.

On the other hand, clear difference was observed in the T_i profiles. The T_i value for the He dominant case exceeded that for the H dominant case in whole plasma region and the central T_i was 1.6 times larger. Also R_{ax}/L_{Ti} was found to be larger in He dominant case except for the region in $0.7 < r_{eff}/a_{99} < 0.95$.

In the future work, the effective ion thermal diffusivity will be evaluated for each case from the power balance analysis taking account of the difference of the ion density. Furthermore we will compare the experimental results with the turbulent/transport simulation to investigate whether the results can be explained by the existing simulation model.

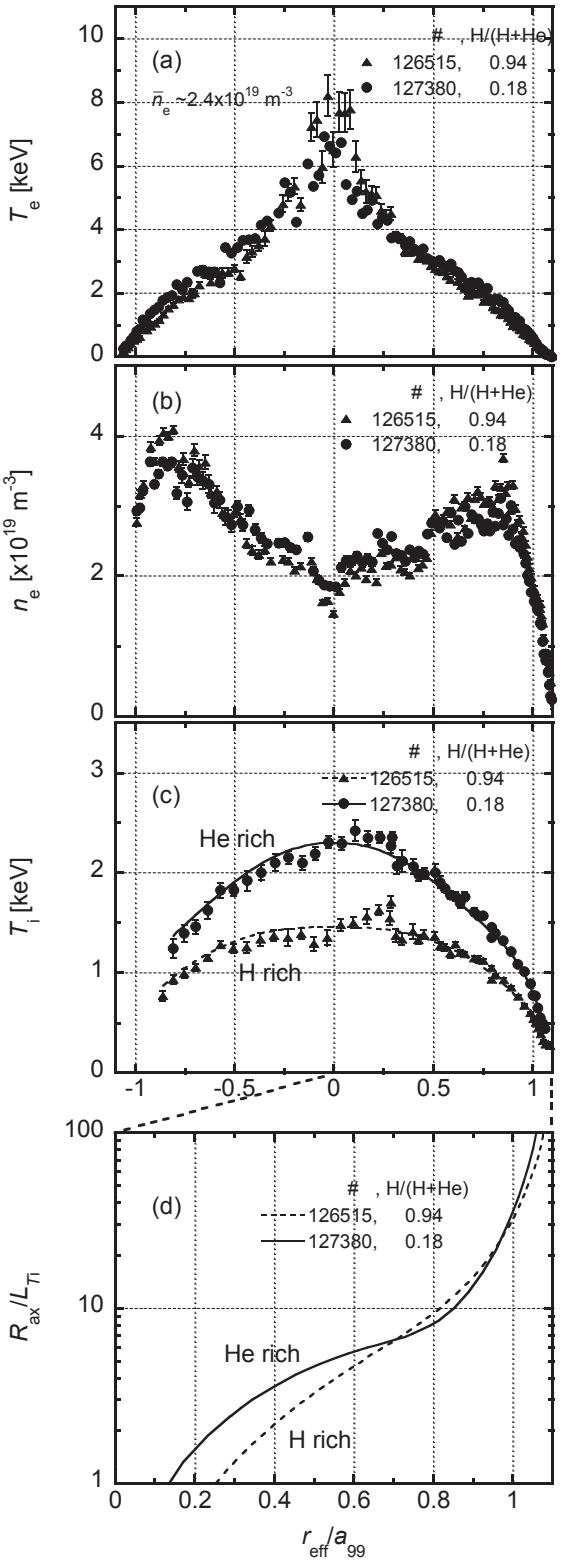

Figure 1. The radial profiles of (a) T_e, (b) n_e, (c) T_i, and (d) R_{ax}/L_{Ti} for the H dominant (#126515) and the He dominant plasma (#127380) with the line-averaged n_e of ~2.4x10^{19} m^{-3}.