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Effect of the Transition to Improved Core Confinement Observed in the LHCD Experiment at FT-2 Tokamak

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To explain a relatively good efficiency of LHCD and improved core confinement transition obtained at the small FT-2 tokamak ($R = 0.55m$, $a = 0.08m$, $B_T \leq 3T$, $I_{pl} = 35kA$, f_0 = 920MHz, Δt_pl = 50ms, Δt_RF = from 30ms to 36ms) [1] a thorough modeling of experimental data has been performed. Effect of LHW on the transition into improved core confinement regime is discussed in the deuterium plasma experiment. It was observed, that in the LHCD experiment with initial OH density $\langle n_e \rangle = 1.6 \times 10^{19} m^{-3}$ the central electron temperature Te(r = 0 cm) measured by TS diagnostics increases during RF pulse from 550eV to 700eV and that is accompanied by cooling of the plasma periphery and the density rise. This effect could not be explained by increase of working gas or impurity recycling because the Dβ line intensity and radiation losses during RF pulse is not appreciably changed.
According to GRILL3D, FRTC and ASTRA codes modeling the increase of the density and electron temperature Te inside of r < 3cm (despite the decrease of ohmic heating power POH at LHCD) happens due to strong reduction of the electron transport in this region where the magnetic shear vanishes, and the value of thermal diffusivity χ_e,eff decreases. Broadening of the plasma current profile by noninductive LHCD results in flattening of the safety factor q - profile in the plasma column center. As the result, the magnetic shear s = (r/q)(dq/dr) in the center became low, or even negative. In such a case the transport code (where the electron transport was described by the mixed Bohm and gyro-Bohm model) predicts a reduction of the transport [2].
Paper presents new experimental data and modeling results appropriate to the transition to improved core confinement during LHCD experiment. In particular, special attention one attends to the experimental periphery data and data of the threshold power for transition to improved core confinement in deuterium/hydrogen plasma.
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References
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