Experiments and simulations of transitions from high to low particle confinement in ohmic and ecrh discharges with different currents on the T-10 tokamak

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It was shown in our previous papers [1 – 3] that in the low-recycling ohmic discharges, the phase with high particle confinement is established after gas puffing switch-off. However, this phase lasts a short time (~ 100 ms), and then the sharp transition to low particle confinement occurs over the whole plasma cross section. For brevity, we term such transition as a “phase transition” from the high particle confinement to the low particle confinement mode. These results were obtained in the T-10 tokamak for discharges with current *I* = 0.22 MA and magnetic field *B* = 2.4 T (*qL* = 3.3). Also the mathematical model of particle confinement and phase transitions based on the canonical profiles approach was developed. In the high-recycling ohmic discharges the phase transitions are absent.

Here we present results of similar experiments performed in the low-recycling discharges with currents *I* = 0.15, 0.22 and 0.3 MA. We show that the phase transitions occur at other currents, but the relative jump of diffusion coefficient decreases with the current increase. Analysis allows us to determine the diffusion coefficient at the high confinement phase and the relative jumps of diffusion for various currents. Figure 1 shows the evolution of diffusion coefficient *D* at the plasma mid-radius ρ = *a*/2 for three shots with various currents. We see that during the high confinement phase the diffusion coefficients for shots with various current are close to each other. After transition to low confinement the jump of *D* depends on the current. Figure 2 shows the relative jump of diffusion coefficient as a function of safety factor *qL* for three ohmic shots with different current. We see that value of jump almost linearly grows with *qL* (decrease of current). The similar analysis was performed for ECRH shots.

The work was funded by grants RSCF 14-22-00193 and RFBR 17-07-00883 and 17077-00544.

Fig. 1. Fig. 2.

References

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