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TRANSPORT SIMULATION OF THE T-15MD TOKAMAK DISCHARGES WITH REDUCED PLASMA VOLUME BASED ON THE CANONICAL PROFILE TRANSPORT MODEL *)

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In [1], the possibility of obtaining equilibrium configurations with a reduced plasma volume in the T-15MD tokamak was shown. That kind of discharges makes it possible to increase the power density of additional heating that results in easier achievement of improved confinement modes. In this paper, we simulate the transport in the T-15MD plasma with a reduced volume with ohmic and ECR heating for magnetic field B = 1 – 2 T. Hydrogen plasma in a limiter configuration of circular cross section with a small radius a = 0.3 m is considered.

Transport simulation is carried out using the canonical profile transport model (CPTM) [2]. The equations for the electron temperature T_e, ion temperature T_i and current diffusion are solved. The plasma density profile is set in such a way that, in normalized coordinates $\rho = r/(IR/B)^{1/2}$, the normalized calculated pressure profile in all modes has the canonical form $p(\rho)/p(0) = (1 - \rho^{3/2})^3$, in accordance with observations on different tokamaks [3].

The expected values of the electron and ion temperature and energy confinement time over a wide range of the plasma densities in regimes with ohmic and ECR heating at different positions of the plasma (R = 1.13 m, 1.5 m, 1.87 m, aspect ratio A = 3.8 – 6.2) are obtained. For ohmic heating regimes the electron and ion temperature profiles calculated for the T-15MD tokamak are compared with experimental data obtained at the T-10 in equivalent discharges with low toroidal magnetic field (B = 1.55 – 2.1 T). The results of transport simulation show that at low plasma densities the energy confinement time τ_e in the hydrogen plasma T-15MD is essentially independent of $\overline{n_e}$, i.e. a saturated ohmic confinement (SOC) mode is observed. On the other hand in the deuterium T-10 plasma τ_e linearly rises with an increase in the average density, that is a linear ohmic confinement mode (LOC) is observed.

References

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