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IMPROVED ENERGY CONFINEMENT IN T-10 OHMIC PLASMA WITH A REDUCED GAS INPUT *)

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The effect of improving energy retention with a decrease in gas input previously was observed in experiments on the T-10 tokamak. As studies have shown, including on other tokamaks [1], this mode of improved confinement is of a transient nature and is not independently maintained in a stationary state. To obtain this effect in a quasi-stationary mode, it is proposed in [2] to use a periodic injection of working gas pellets. As experiments on the LHD and W7-X stellarators have shown, after pellet injection, the relaxation in the plasma occurs with a density peaking, subsequent self-organization of the plasma and a transition to an improved confinement mode as the plasma density decreases. To optimize the proposed method for obtaining such a quasi-stationary mode of improved confinement, in [2] indicates the need to study the nonlinear dynamics of the main parameters profiles to determine the plasma response after pellet injection.

This report presents the results of experiments in which the effect of improved energy confinement was obtained with reduced gas injection in the OH plasma of the T-10 tokamak. After a decrease in the gas input value, a transition to the improved confinement regime occurs, which is accompanied by an increase in the central values of density n_e (0) and temperature $T_e(0)$, $T_i(0)$, an increase in the energy confinement time τ_E and an increase in the neutron yield. As an analysis of the evolution of temperature and density profiles shows, a decrease in gas injection causes a density disturbance at the periphery and a nonlinear plasma response. According to measurements of turbulence characteristics by using a correlation reflectometer, the transition to the enhanced confinement mode is accompanied by a change from the dominant ITG instability to the TEM instability. The further evolution of plasma parameters continues for more than 50 ms, during which a restructuring of the temperature and density profiles occurs, accompanied by an increase in τ_E. The restructuring of the profiles ends with regime bifurcation, a change in the dominant instability, a decrease in density, and the loss of the effect of improved confinement. The analysis shows the nonlinear nature of the dynamics of the T_e (r) and n_e (r) profiles and their self-organization. In the report the results of calculations of transport fluxes and transport coefficients of particles and heat in the ion and electron components performed using the ASTRA code in the considered transition regime are presented.

References

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*) abstracts of this report in Russian