FEATURES OF THERMAL QUENCH IN CASE OF MASSIVE GAS INJECTION into the T-10 tokamak

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Due to put in operation more and more powerful plasma systems, it is becoming increasingly urgent problem of preventing major disruptions and controlled quench of the plasma discharge. It should be noted that the physics of the processes occurring at disruption, largely depends on the geometry of a magnetic system and available confinement modes than from the energy of the plasma discharge. This allows to study this subject on small and medium-sized machines, which is followed by extrapolation and testing of results on large machines with magnetic confinement of high temperature plasma.

To study the various options of initiation and evolution of plasma disruption and suppression of runaway electron beams necessary to use a variety of active systems impacts on the plasma to test various scenarios of controlled quench of the plasma discharge. On the T-10 tokamak has the ability to apply next active systems: firstly, it is the main control system to execute programs controlling plasma current, magnetic fields and operation of piezovalves for the puffing of the working gas, and secondly, a placed at port and positioned pulsed gas valves, injectors of hydrogen and impurity pellets (now the first one has equipped the chord pellet injection system), and the ECRH, and a movable and lithium limiters [1]. It should be noted that the unique systems of positioned MGI valve [2] and chord pellet injection allow to perform the study of disruption parameters in dependence on the source position relative to the plasma boundary and the impact parameter of pellet injection, correspondingly, and compare the options of co- and counter-pellet-injection.

The report presents the results of simulations of plasma disruption in the T-10 tokamak using code ASTRA, including discharges with disruption initiated by MGI. The focus is on the development phase of the thermal quench and examined the effect of different channels heat losses during quench evolution. It is shown that the initial phase of the slow phase of thermal quench can be described by the selection of the sources and transport coefficients, while to describe the quick final phase of the thermal quench is necessary to consider the increment of instabilities and reconnections in the plasma.

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References

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