COMPARISON OF VARIOUS METHODS OF FUELLING OF T-10 TOKAMAK

V.G. Kapralov, 1M.M. Dremin, V.E. Frolov, 1S.V. Krylov, 1A.S. Trubnikov, I.A. Sharov, V.V. Elagin, D.R. Totrov

SPbPU, Saint-Petersburg, RF, kapralov@phtf.stu.neva.ru
1NRC «Kurchatov Institute», Moscow, RF, Dremin\_MM@nrcki.ru

Sharp disruptions of plasma discharge and arising runaway electron beams are an increasingly serious problem for modern plasma machines with magnetic confinement of high-temperature plasma as their size and energy increase, which makes it important to study the processes associated with disruption of the plasma discharge and the selection of optimal scenarios for its mitigation.

In the T-10 tokamak database, data on experiments with various methods of quenching a plasma discharge are present: massive high-pressure helium gas injection [1], massive low-pressure argon gas injection [2], pellet injections [1, 3, 4], regular gas puffing using piezo-valves, as well as discharges without an external initiation of disruption [1].

In the experiments, a regular gas puffing system of the T-10 tokamak and a positioning valve (PMGI) were applied, last one was for injecting low-pressure argon or high-pressure helium and . The mobile valve for the massive gas injection could be moved relative to the plasma boundary, which made it possible to scan the parameters of the disruption depending on the distance from the source of the gas jet to the plasma.

Modeling of all the listed variants of plasma disruption in the T-10 tokamak [2], both with the use of active systems to disturb the plasma, and without them, was carried out using the ASTRA code. Simulation provided an opportunity to compare the 4 variants of the disruption initiation (reaching the maximum density, injection of particulates and two options of the massive gas injection), as well as highlighting their characteristics that are important for optimizing the scenarios of plasma quench mitigation. During the simulation, the possibility of changing the confinement regimes due to injection of gas or pelletes was considered, and a comparison with previous results was performed [4,5].

The authors thank the staff of the T-10 tokamak for the data and support provided.

References

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