COMPARISON OF discharge disruptionS caused by PELLET FUELING and massive GAS INJECTION in T-10 tokamak

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As the size and power of modern facilities with magnetic confinement of high temperature plasma increases technical problems which are results of hard disruptions of plasma discharges and formed in them runaway electron beams. All this increases the relevance of studying the processes of energy output from the plasma and the selection of the optimal scenario of plasma quench

Series of experiments was performed on T-10 tokamak. Plasma disruption was triggered by the fuel pellet injection, a massive gas injection of high pressure helium or low pressure argon. These experiments allow to compare the four options for the forced quench of discharge (reaching of the limit density, the pellet injection and two versions of a massive gas injection) and highlight their characteristics, which are important for the optimization scenarios of the plasma quench. This work is a continuation of research that partially published in [1, 2].

The report is a comparison of both physical and technical parameters of the subject processes to initiate disruption. Technical parameters are important for testing the optimal scenario of the plasma quench, as without their registration can not be correct synchronization of the control systems of discharge and diagnostics, as well as scaling of scenario parameters for other tokamaks.

Among the parameters considered include the intervals from the formation of the precursor to actuation mitigation system, and by the last one to the start of plasma quench, the type and duration of the heat and the current disruption, the power ratio of the plasma radiation in the visible, soft and hard X-ray range, the characteristics of instabilities and the formation of runaway electron beams, and the presence of secondary disruptions during the current quench.

It is shown that the described systems can be placed in the following order to increase the hardness of triggered disruption: the ordinal gas puffing, the massive gas injection in the far region, the massive gas injection in the near region, and, finally, the pellet injection.

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References

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