effect OF FAST GAS FLOW INJECTION ON THE PLASMA DISCHARGE hutdown IN TOKAMAKs [[1]](#footnote-1)\*)

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Injection of intense gas flows and pellets is actively used to safely stop the plasma discharge in modern tokamak experiments and is considered as the main system for preventing the development of the runaway electron beams in the ITER tokamak [1]. One of the main limitations in the use of these systems in large-scale tokamaks is the weak penetration of injected particles into the central zones of the plasma discharge. This reduces reliability of the disruption stabilization and leads to the need to develop additional methods for safe discharge termination.

To minimize the consequences of disruption in the plasma of the T-10 tokamak, “alternative” methods of injection of gas flows are considered, including the initiation of fast chemical combustion reactions, the injection of neutral particles from targets when the potential is applied (voltage U = 0–450 V, battery capacity C = 0.4 F, maximum energy reserve W = 40.5 kJ) and injection of impurities by evaporation of targets using high-power microwave waves (RHF up to 1 MW). The experiments performed on the T-10 tokamak showed the effective penetration of fast gas flows into the central zones of the plasma discharge and demonstrated the possibility of quickly stopping the plasma discharge with a current decay rate of up to 35–40 MA/s and a control system response time of up to 0.1 ms.

A preliminary analysis showed possibility of using fast-flowing chemical reactions in an ITER-type tokamak reactor to generate directed gas flows based on initiating substances [2] with increased radiation resistance to fast neutron fluxes (E > 1 MeV) F ~ 7.5 1012 neutron/cm2/s, temperature stability (T ~ 280–300oC) and stability under high vacuum.

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References

1. E.J. Strait et al., 2019, Nucl. Fusion 59, 112012 (<https://doi.org/10.1088/1741-4326/ab15de>).
2. W.E. Voreck, M.E. Downs, E.I. Lindberg, AEROJET GENERAL Corporation, California, Report No. RN-S-0368, 1967 (<https://www.osti.gov/servlets/purl/4221497>).
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/E/ru/JB-Savrukhin.docx) [↑](#footnote-ref-1)