DOI: 10.34854/ICPAF.51.2024.1.1.079

STUDY OF ENERGY BALANCE IN GAS DYNAMIC TRAP *)

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Open systems for magnetic plasma confinement are quite prospective for a range of applications in the field of controlled nuclear fusion. From an engineering and physical point of view, the closest possible application of a mirror cell of the simplest design is a D-T nuclear fusion neutron source capable of producing a neutron flux with a power density of several megawatts per square meter [1]. A neutron flux of this level is required to conduct full-scale materials science research necessary to design the first wall and other elements of future fusion reactors. Also a powerful neutron generator can be used to control subcritical fission reactors, including devices for "afterburning" long-lived radioactive waste [2]. Open-type magnetic traps with improved longitudinal particle confinement relative to a simple mirror cell can be the basis for creating nuclear fusion reactors with a power amplification factor Q>>1, which are capable of operating with alternative fuels that do not contain radioactive tritium. A prototype project for such a reactor is currently being developed at the Budker Institute of Nuclear Physics [3].

The key parameter from the point of view of applications is the energy efficiency of the system, which means that studying possible channels of energy loss from the system is critically important to validate feasibility of the design of future thermonuclear machines based on an open magnetic trap. Such studies were previously carried out on a GDT device in a configuration with an atomic injection duration of 1 ms [4]. The modern GDT is equipped with injectors with a duration of 5 ms, the scenario for creating and maintaining a discharge has also undergone changes, the obtained parameters have approached thermonuclear values [5], so the task of studying the energy balance is still relevant. The report will present a description of the diagnostic systems developed for this task, the results of measurements of energy flows into the plugs of the installation [6], onto the radial limiters, as well as onto the wall of the vacuum chamber, and estimates of the total energy losses from the device in different operating modes will be given.

References

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*) abstracts of this report in Russian