tritium FUEL CYCLE STANDS OF fusion FACILITY [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.024

1,2Shishkova T.A., 1Ivanov B.V., 1Ananyev S.S., 1Kuteev B.V.

1NRC «Kurchatov Institute», Moscow, Russia, [anfimova\_t\_a@mail.ru](mailto:anfimova_t_a@mail.ru),  
2 University of Chemical Technology of Russia, Moscow, Russia

It is necessary to develop a deuterium-tritium fuel cycle to ensure the operation of any fusion or hybrid fusion-fission facility. Playing an important role in the operation of the reactor, the fuel cycle (FC) ensures the circulation of hydrogen isotopes in the vacuum chamber, pumping and fuel injection systems to maintain plasma parameters, as well as normal operation of the facility and personnel safety [1]. The FC includes systems that perform the functions of storing deuterium and tritium, pumping out the "exhaust" from the vacuum chamber, impurity removal and processing the isotope mixture for reuse, etc. The respective fuel cycle systems are based on individual technologies – membrane separation, sorption storage, chromatographic separation, etc.

The criteria for choosing fuel cycle technologies are compliance with the required performance indicators of individual functional fuel cycle systems, as well as reducing the amount of tritium in fuel cycle systems [1]. A necessary stage in the development of technologies is the creation of full-scale mock-ups of technological systems, their integration and development of joint work with tritium. This stage should be preceded by bench tests of various parts of installations with their characteristic model gas mixtures. The need to create a bench base is determined by the existing need for the development of technologies and testing of fuel cycle materials. The program for the development of fusion and hybrid fusion-fission systems, implemented by the National Research Center "Kurchatov Institute" within the framework of the federal project "Development of controlled thermonuclear fusion and innovative plasma technologies" of the comprehensive program of the Rosatom State Corporation, provides for the creation of a complex of laboratory stands, including for the preparation of a scientific personnel and improve the performance of systems [3] in 2023-2025.

The complex of stands for testing fuel cycle technologies is a complex of equipment (standard or specially designed and manufactured) and premises prepared for experiments and testing of technologies with light hydrogen isotopes. The report is devoted to the description of technologies considered for the complex of stands for the fuel cycle. The paper considers sorption storage methods, a membrane-catalytic method for removing impurities, chromatographic separation of hydrogen isotopes for storage, purification and processing of the fuel, respectively.

The work was supported by the National Research Center "Kurchatov Institute".

References

1. Ananyev S.S., Ivanov B.V., Kuteev B.V. // Fusion Eng. Des. 161 (2020) 111940.
2. Ivanov B.V., Ananyev S.S. Probl. A. Sci. Technol. Ser. Termonucal. Fusion, 44 (4), 5 (2021)
3. Ananyev S.S., Ivanov B.V. et al. 49 Zvenigorod international conference on plasma physics and controlled fusion, 2022, <http://www.fpl.gpi.ru/Zvenigorod/XLIX/Sbornik_ICPAF-2022.pdf>

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/AU-Shishkova.docx) [↑](#footnote-ref-1)