MEPhIST-0 tokamak: First results [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2022.49.1.061

1Krat S.А., 1Prishvitsyn А.S., 1Alieva А.I., 1Efimov N.Е., 1Vinitskiy Е.А., 1,2Ulasevich D.L., 1Izarova А.D., 1Podolyako F.S., 1Perevozchikova О.А., 1,3Mesheryakov А.I., 1,4Sorokin I.А., 1,2Melnikov А.V., 1Grunin А.V., 1Begrambekov L.B., 1Kaziev А.V., 1,4Kolodko D.V., 1Isakova А.S., 1Belov А.S., 1Gubskiy K.L., 1,5Ongena J.

1National research nuclear university MEPhI [info@mephi.ru](mailto:info@mephi.ru)  
2National research center Kurchatov Institute  
3Prokhorov General Physics Institute of the Russian Academy of Sciences  
4Institute of Radio-engineering and Electronics Of Russian Academy of Sciences  
5Ecole Royale Militaire / Koninklijke Militaire School

Tokamak MEPhIST-0 [1] is an educational spherical tokamak created at NRNU MEPhI in 2019-2021. The large radius is 25 cm, the small radius is 13 cm, the vertical elongation of the discharge chamber is ~ 2. The expected duration of the discharge is ~ 10-30 ms. The calculated operating limits are described in [2]

The main tasks of the tokamak are the training of scientific personnel, the testing of diagnostics on a small scale for further work on large installations, and research in the field of plasma-surface interaction. To achieve these goals, work is underway to improve the characteristics of the tokamak, equip the tokamak with additional diagnostics.

For the period of 2021, the power supply of the tokamak was increased by ~ 30 times. The maximum value of the toroidal field of ~ 0.8 T was achieved. A number of magnetometric studies of tokamak systems have been carried out, the tokamak inductor has been optimized from the point of view of scattered fields. An RF antenna for ICR plasma heating was developed and manufactured, additional RF power was introduced into the discharge chamber of the tokamak. The tokamak is was with a remote control system and a separate control room.

To determine the plasma parameters Mirnov magnetic sensors and a Rogowski coil were installed in the discharge chamber. A diamagnetic loop and an additional Rogowski coil were installed outside the chamber. Spectroscopic viewports were installed and measurement of the chordal plasma density was realized by means of a heterodyne interferometer. Also, the signal of the H alpha line was recorded as a function of time, and the discharge was filmed at a rate of 10,000 frames per second. A universal mechanized movable prove with replaceable heads was constructed, which makes it possible to carry out probe measurements, as well as experiments on the plasma-surface interactions. The probe heads can be changed without venting the installation using a loadlock system

Using Langmuir probes, the parameters of the microwave pre-plasma in the near-wall region were determined. Density ~ 5 × 1010 cm-3, electron temperature ~ 8 eV.

A current-carrying discharge was created. The discharge lifetime is ~ 0.4 ms, the achieved plasma current is ~ 3 kA, and the plasma density is ~ 3 × 1012 cm-3. X-rays were detected during the discharge.

References

1. V.A. Kurnaev, G.M. Vorobyov, V.E. Nikolaeva, S.A. Krat, A. V Melnikov, D.P. Ivanov, Y.M. Gasparyan, The Project of MEPhIST Tokamak, Phys. At. Nucl. 82 (2019) 1329–1331. doi:10.1134/S1063778819100144.
2. N.A. Kirneva, G.M. Vorobjev, S.A. Ganin, A.S. Drozd, I.S. Kudashev, V.V. Kulagin, V.A. Kurnaev, WORKING AREA OF THE MEPHIST TOKAMAK: PRELIMINAR ESTIMATION, Probl. At. Sci. Technol. Ser. Thermonucl. Fusion. 43 (2020) 90–100. doi:10.21517/0202-3822-2020-43-3-90-100.

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