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STATUS OF THE NEXT GENERATION SPHERICAL TOKAMAK CONCEPT GLOBUS-3^{*)}

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The report analyzes the concept of the next generation Russian spherical tokamak - the Globus-3 project. Of the considered approaches to design an electromagnetic system (“warm” coils made of copper alloys, the option with preliminary cooling of the coils, the use of LTSC or HTSC), the option with “warm” copper was chosen as the first step. Calculations have shown that the available at the Ioffe Institute infrastructure, including building limitations, allows ensuring the operation of the spherical tokamak with a toroidal magnetic field $B_t = 1.5\text{--}3.0$ T, a plasma current $I_p \sim 1$ MA, a discharge duration Δt_{pulse} of several seconds with a major radius R of less than a meter. Such parameters of the new installation are a reasonable extrapolation of the Globus installation system (Globus-M: $B_t = 0.4$ T, $I_p \sim 0.2$ MA, $\Delta t_{\text{pulse}} \leq 0.3$ s, $R = 0.36$ m; Globus-M2: $B_t = 0.9$ T, $I_p \sim 0.5$ MA, $\Delta t_{\text{pulse}} \leq 0.5$ s, $R = 0.36$ m).

The parametric analysis carried out allowed choosing the preliminary parameters of Globus-3 tokamak for subsequent engineering design: $B_t = 1.5$ T, $I_p \sim 0.8$ MA, $\Delta t_{\text{pulse}} \leq 2\text{--}3$ s, $R = 0.76$ m.

Calculations of the basic scenario of a plasma discharge lasting up to 3 s, a set of thermophysical and mechanical calculations were carried out, which made it possible to design the concept of the electromagnetic system and the vacuum vessel of the tokamak.

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References

- [1]. V.B. Minaev, A.B. Mineev, N.V. Sakharov, Yu.V. Petrov, N.N. Bakharev, E.N. Bondarchuk, A.V. Bondar, V.I. Varfolomeev, A.A. Voronova, V.K. Gusev, V.V. Dyachenko, A.A. Kavinb, I.V. Kedrovb, A.Yu. Konin, A.M. Kudryavtseva, G.S. Kurskiev, A.N. Labusov, I.V. Miroshnikov, I.Yu. Rodin, V.N. Tanchuk, V.A. Trofimov, O.G. Filatov, P.B. Shchegolev. Plasma Physics, 2023, T. 49, No. 12, P. 1375

^{*)} [abstracts of this report in Russian](#)