Plasma edge modeling of "Globus-M2" tokamak with nitrogen injection including carbon impurity.

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This work is devoted to the reduction of heat fluxes to the divertor and to the studying of the possibility of using nitrogen as a radiating impurity for switching to the detachment mode on the compact spherical tokamak Globus-M2 by modeling with SOLPS-ITER code based on experimental data of Thomson scattering diagnostics. Reduction of heat flows to divertor plates is one of the most urgent problem in devices with high power and a relatively long pulse duration since in such devices the density of power flows to divertor plates should not exceed the critical value 10 $\frac{\mathrm{M}Wt}{m^2}$. Although this problem is not acute in the Globus-M2 tokamak, it is an excellent platform for studying the physics of controlled nuclear fusion. The main idea of switching to the detachment mode by the radiating impurity seeding is reducing the power flow to the divertor plates due to radiation loss by the input impurity. At the same time, it is necessary to take into account the distribution of the impurity in the device and avoid its accumulation in the confinement zone. Also, it is important to choose the type of impurity, the impurity injection rate and the location so that the overwhelming percentage of the radiated power falls on regions which are not the confinement zone. This work presents the results of modeling the discharge of the Globus-M2 tokamak with different nitrogen injection rates. The purest of the presented cases agrees well with the experimental data obtained during discharge №38361 at 197 ms. According the modeling results with an increase of the nitrogen injection rate, it can be concluded that the transition to the detachment is possible in H-mode at the device , which coincides with the experiments conducted at the ASDEX-Upgrade tokamak[1]. However, due to the lack of experimental data the question remains open whether the Globus-M2 will repeat the discharge scenario of the COMPASS[2] tokamak where it was possible to obtain only detachment in L-mode, as noted, due to insufficient additional heating power and high radiation losses in the confinement zone.

1. Perez I.P. et al 2017 Nucl. Mater. Energy 12 182–6

2. M. Komm et al 2019 Nucl. Fusion 59 106035