MODELING OF SPECIAL DETACHMENT REGIMES FOR THE ITER TOKAMAK-REACTOR

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Abstract

The given work is devoted to SOLPS-ITER modeling of edge plasma of the ITER tokamak-reactor. The Scrape-off-layer (SOL) width for ITER nowadays is unknown. The SOL width determines the load on the divertor plates. The experimental scaling predicts the SOL width for ITER is about a millimeter [1] and such width can lead to exceeding the power flux at the divertor plates. Kinetic modeling predicts SOL width for ITER is about 3-4 mm [2]. Another important issue is the mechanism of the SOL forming in the cases of a narrow SOL and predicted one. In [3], a simulation was made for ITER with a reduced SOL width due to decrease of anomalous transport coefficients in the SOL. Drift effects were not considered in that simulation, but they can be important in the narrow SOL case. The goals of this work are the SOLPS-ITER simulation of the edge plasma of the ITER tokamak-reactor with different anomalous transport coefficients, leading to different SOL widths cases, SOL width and the mechanism of SOL formation analysis and the role of drift effects analysis for these cases.

This work shows that the SOL power flux width is 1.65 mm when the anomalous transport coefficients in SOL decrease by 4 times. In this case flux associated with magnetic drift make a significant contribution to the particles transport. In the case of “standard” transport coefficients for ITER modeling, the SOL width is 3.43 mm and can be achieved only under the anomalous turbulent transport. In the simulation of narrow SOL with a neutral pressure 7 Pa at the divertor region the power load to the outer divertor plate is 11.4 MW / m2 that exceeds the limit of 10 MW / m2. The obtained results were included in work [4] and confirm the conclusion that there is a narrow operation window for the future ITER tokamak-reactor, which does not lead to exceeding the permissible loads on the divertor plates.

References

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