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COMPARATIVE MODELING OF TRANSPORT OF BERYLLIUM AND BORON IMPURITY PARTICLES IN THE DTR DIAGNOSTIC CHANNEL *)

Bocharnikov V.A., Varshavchik L.A., Starovoitov E.A., Galitzine D.D., Nikitenko S.A., Muhin E.E.

Ioffe Institute, Saint Petersburg, Russian Federation, vladislav.bocharnikov@mail.ioffe.ru

Selection of material for the first wall of next-generation tokamaks and, in particular, the international thermonuclear experimental reactor ITER affects the performance of optical diagnostics. Recently, it has been proposed to replace beryllium with tungsten with a boron-containing film coating. It is assumed that the reactor plasma will contain a high rate of impurity particles sputtered from the first wall surfaces. Particles that are heavy compared to the plasma-forming gas drift from the reactor main volume into the diagnostic channels and are deposited on optical surfaces, that significantly reduces the efficiency of optical plasma diagnostics. Therefore, it is necessary to perform the work in order to prevent possible diagnostic systems failures, one of which is the modeling of the impurities transport and calculating the rate of its deposition in diagnostic channels.

This paper discusses the impurities deposition onto the first optical element surface of the divertor Thomson scattering (DTS) diagnostic system 55.C4. The divertor is the area where the sputtering of the first wall is supposed to be the most intense and the concentration of impurity particles to be the highest. The current report presents the modelling results for the transport of beryllium and boron impurity particles in the DTS diagnostic channel and the estimation of the contamination rate of the first mirror. For this purpose, the Monte Carlo code KITe was created [1], which allows to simulate the processes of transport, sputtering and deposition of materials of the first wall and other structural elements. The information about fluxes of beryllium and boron ions and atoms coming from the central plasma to the reactor first wall, calculated by the SOLPS-ITER code, was used as an input data for the calculation.

During the work, the distribution profiles of the incident and sputtered flows of beryllium and boron particles were obtained, and an estimation of the contamination rate of the first optical element of the DTS diagnostics was performed. A comparative analysis of the results obtained for both materials was carried out resulting into conclusions about the expected contamination rate of the first mirror surface.

References

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