INFLUENCE OF THE POLARIZATION SCRAMBLING IN WALL REFLECTION ON MULTIPASS ABSORPTION OF EXTERNAL EC RADIATION AT THE INITIAL STAGE OF DISCHARGE IN ITER [[1]](#footnote-1)\*)

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Due to the technological issues ohmic breakdown of the working gas in tokamak-reactor ITER will be possible for a narrow range of neutral gas pressure values and limited impurity content [1]. Therefore, at the initial stage of the discharge in ITER for ionization of the working gas, overcoming the radiation barrier and raising the plasma current the use of electron cyclotron (EC) resonant heating is foreseen [2], [3].

For simulations of the initial stage of the discharge in ITER, the 0D models [1], [4], [5], [6] have been developed, describing the two main components of the problem in different ways: the behavior of impurities that increase the radiation barrier and the absorption of the injected EC radiation power, required for reliable plasma formation. In ITER EC heating system with injection of an ordinary EC wave from the low magnetic field side is planned [7]. Due to the low values of the electron temperature and density at the initial stage of the discharge the single pass absorption of the ordinary EC wave power will be small. The power required to overcome the radiation barrier is absorbed due to multiple reflections of EC waves from the wall of the vacuum chamber with accounting of polarization scrambling (mode conversion) in wall reflections. To simulate this effect, a model of multipass absorption of EC radiation at the initial stage of the discharge in ITER was proposed [8], and for taking into account the absorption on several passes of the EC wave the beam codes (for example, the GRAY code in [4]) are used.

In the present work we analyze within approach [8] the effect of polarization scrambling in wall reflections on the multipass absorption of external EC radiation at the initial stage of the discharge in ITER. It is shown that the intensity of the radiation in the chamber, absorbed in the case of multipass, significantly depends on the mode conversion parameters upon reflection from the wall.

References

1. Lloyd B., Carolan P.G., Warrick C.D., Plasma Physics and Controlled Fusion, 1996, 38, 1627-1643.
2. ITER Physics Expert Group on Energetic Particles, Heating and Current Drive, ITER Physics Basis Editors, Nuclear Fusion, 1999, 39, 2495.
3. Stober J., Jackson G.L., Ascasibar E., Bae Y.S., et al., Nuclear Fusion, 2011, 51, 083031.
4. Granucci G., Garavaglia S., Ricci D., Artaserse G., et al., Nuclear Fusion, 2015, 55, 093025.
5. Kim H.-T., Fundamenski W., Sips A.C.C., Nuclear Fusion, 2012, 52, 103016.
6. Ricci D., Farina D., Figini L., Granucci G., et al., Proc. 43rd EPS Conference on Plasma Physics, Leuven, Belgium, 2016, O5.130.
7. Omori T., Henderson M.A., Albajar F., Alberti S., et al., Fusion Engineering and Design, 2011, 86, 951-954.
8. Minashin P.V., Kukushkin A.B., Khayrutdinov R.R., Lukash V.E., Problems of Atomic Science and Technology, ser. Thermonuclear Fusion, 2013, 36, 76-84 (in russian).
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/E/ru/HR-Minashin.docx) [↑](#footnote-ref-1)