DETERMINATION OF THE CHARGED PARTICLES SOURCE USING SPECTRAL DIAGNOSTICS OF THE T-10 TOKAMAK [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.053

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| Figure - Profiles of various components of an ionization source of electrons (*Te*(0) = 1 keV, *ne*(0) = 4,2⋅1013 cm-3) |

The paper is dedicated to the evaluaton of the electrons and ions source magnitude Λ, carried out by processing the data from spectroscopic measurements of the main gas and impurities lines.

The total value of the electron source was determined as the sum of the sources created by the atoms of the main gas (ΛD), as well as by the atoms and ions of impurities C (ΛC) and O (ΛO). ΛD consisted of two components: a wall source averaged over the torus surface (ΛD,*wall*) and a local source from the zone near the limiters (ΛD,*lim*).

ΛD,*lim* is determined from the radiation intensity of the Dα line in the limiter section of the tokamak recorded with an endoscope. To obtain absolute values of Dα intensity, the absolute calibration of the endoscope was carried out using a calibrating source. ΛD,*wall* is determined as a result of calculations of D atoms radial transport using the ASTRA code. Two components of the flux of deuterium atoms from the chamber wall were taken into account: “cold” one (3 eV, D*kond*) and “hot” one (50 eV, D*heat*). The energy and the ratio of their concentrations *n*D*kond* / *n*D*heat* = 5 / 1 is determined from the analysis of the spectrum of the Dα line. The boundary condition *n*D(*aL*) was set from the condition of coincidence with the absolute brightness of Dα. The ionization sources from impurities ΛC and ΛO are determined by describing in the model the radial profiles of the densities of carbon and oxygen nuclei determined from CXRS measurements. The ionization states of impurities were calculated using the STRAHL code taking into account neoclassical and anomalous transport coefficients [1].

The calculations made it possible to establish the spatial dependence of the source power on the radius, presented in the Figure. It is mostly concentrated in the region (0.75...1) ⋅ *aL*. From the endoscopic measurements, it is found that the ratio between fluxes ΛD,*wall* and ΛD,*lim* is as 1 to 2...3. The fraction of the electron source from the plasma impurities (carbon, oxygen) does not exceed 25% in OH discharges with a value of *Z*eff ~ 2...3.

The power of the electron source integrated over the cord is ~2 ⋅ 1021 electrons/s. The density of neutral atoms at the cord boundary is *n*D ~0.7 ⋅ 1010 cm-3.

References

1. V.A. Krupin et.al. Plasma Phys. Control. Fusion 60 (2018) 115003 (20pp)

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Mu/ru/BJ-Zemtsov.docx) [↑](#footnote-ref-1)