EEDF in the COMPASS divertor region during an impurity-seeding experiment

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This work presents results from swept Langmuir probe measurements in the divertor region of the COMPASS tokamak [1] in D-shaped, L-mode deuterium discharges, with toroidal magnetic field B_T = -1.38 T, plasma current, I_{pl} = 210 kA and line-average electron density 4×10^{19} m^{-3}. The electron energy distribution function (EEDF) was studied during a detachment experiment with nitrogen injected into the divertor region.

The measured current-voltage probe characteristics were processed using the first-derivative probe technique [2]. This technique allows to evaluate the plasma potential and the real electron energy distribution function (respectively, the electron temperature and density).

In the divertor region of the COMPASS tokamak, the EEDF of the attached plasma usually deviates from Maxwellian [3], but it can be approximate by a sum of two Maxwellian distributions (bi-Maxwellian EEDF) with a low-energy electron population with temperatures 3.5-5 eV and a high-energy electron group with temperatures 10-25 eV.

During the nitrogen seeding, the EEDF changes to Maxwellian with temperatures 3.5-7 eV. The hypothesis that the fast electrons relax via inelastic collisions with N_2 and a Maxwellian EEDF is formed will be discussed during the presentation.

The poloidal profiles of the plasma potential, electron temperatures and densities are presented and used for calculation of the parallel power-flux density distribution in the divertor region of the COMPASS tokamak before and during the nitrogen seeding.

References:

[1] R. Panek R et al.: Plasma Phys. Control. Fusion, Vol. 58 (2016), 014015.

[2] Tsv. K. Popov et al.: Plasma Phys. Control. Fusion, Vol. 51 (2009), 065014.

[3] M. Dimitrova et al.: Contrib. Plasma Phys., Vol. 54, No. 3 (2014), 255 – 260.