

Study Of Plasmas With Large Populations Of Fast Electrons In ISTTOK

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Abstract

Generation of large populations of fast electrons in the low-density ISTTOK plasmas has been deduced in self-consistent numerical analysis of the measured plasma parameters [1] and later detected in direct measurements using the detectors of Cherenkov radiation [2]. This report presents the current status of plasma studies in ISTTOK and development of diagnostic technique based on Cherenkov-type detectors for measurements of runaway and super-thermal electrons. Detectors of the Cherenkov radiation based on different radiation materials have been characterized. 4-channel detector with sintered AlN radiators and new 2-channel and 1 channel detectors based on the diamond radiators have been tested in experiments on the ISTTOK tokamak. This technique enabled the detection of energetic electrons with the energies higher than 50-60 keV in the ISTTOK discharges. The spatial and temporal parameters of the fast electrons detected have been measured to provide the characteristics of runaway generation process in ISTTOK. Obtained experimental data has been analyzed in frames of self-consistent 0-D calculations of the plasma power-energy balance on the basis of the measured plasma parameters and the theory of runaway generation process. The plasma relaxations, a typical satellite effect of the instability driven by the runaway electrons, were observed in experiments and analyzed. An adequate correspondence of the measured plasma parameters including the fast electron characteristics to the results of the ISTTOK plasma processes modeling has been found.

[1] V. V. Plyusnin et al. Plasma Phys. Contr. Fusion **44** (2002) 2021–2031

[2] V. V. Plyusnin, et al. Rev. Sci. Instr. **79** (2008) 10F505