DIFFUSION HIGH PRESSURE DISCHARGES FORMED BY Runaway Electrons IN INHOMOGENEOUS ELECTRIC FIELD [[1]](#footnote-1)\*)

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Runaway electron generation is a fundamental physical phenomenon that occurs in natural and laboratory discharges, including spark discharges with meter gaps, as well as in installations for producing a controlled thermonuclear reaction. Electron runaway is realized in gases at strong electric fields, if between collisions with gas particles an electron gains more energy than it is loses in inelastic collisions. A large number of works have been devoted to the study of runaway electron generation and the formation of diffuse discharges in an inhomogeneous electric field at high pressures of various gases; see, for example, [1–4] and references therein.

This report presents the results of experimental studies of runaway electron beams generated in various high-pressure gases, and shows the role of runaway and fast electrons in the formation of diffuse discharges in an inhomogeneous electric field. Fast electrons are called electrons with energies of hundreds of eV - units of keV. Electrons with such energies gain energy in the region of the maximum electric field, but falling into the region of a lower field lose their energy and become plasma electrons. The energy of runaway electrons reaches tens to hundreds of keV, and they are relatively easy to detect behind the anode foil or grid by the collector.

The paper describes the setups and optimal conditions for obtaining runaway electron beams with maximum amplitudes. The influence of various factors on the amplitude, duration of the beam current, and the energy of runaway electrons is analyzed. Thus, the maximum amplitude of the beam current recorded by the collector behind the anode foil so far has been ≈100 A with a pulse duration at half maximum ≈100 ps (the number of electrons is 6.2∙1010). It was established that the electron spectrum measured behind the anode foil has three groups, the ratio between the energies and the number of electrons in which depends on many parameters, including the cathode design. It was shown that the generation of fast and runaway electrons ensures the formation of diffuse discharges at high pressures in the absence of an additional source for preionization of the gap. It was found that diffuse discharges are formed due to wide streamers at both polarities of the voltage pulse. The mechanism of runaway electron generation in high pressure gases at a cathode with a small radius of curvature is discussed.

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References

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