

PARAMETERS OF RUNAWAY ELECTRON BEAMS GENERATED IN ATMOSPHERIC PRESSURE AIR*

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The study of runaway electron beams (RAEBs) generated during subnanosecond breakdown of air and other gases continues to attract great attention. In well-known works, the tasks were set to obtain the maximum amplitudes of the beam current, to determine the duration of REAB current pulses and electron energy, as well as to study the influence of the design of gas diodes, the shape and material of electrodes on the parameters of RAEBs. The parameters of RAEBs were measured in various gases in a wide pressure range. Much attention was paid to modeling the physical processes of the RAEB generation.

The purpose of this work is to systematize the experimental data on the parameters of RAEBs in air at atmospheric pressure obtained at the Institute of High Current Electronics SB RAS [1–5]. In particular, the effect of the anode design on the duration of RAEB current pulses was studied. Figure 1 shows the duration of RAEB current pulses recorded at various diameters of the hole in the anode (figure 1a) and at various cathodes (figure 1b).

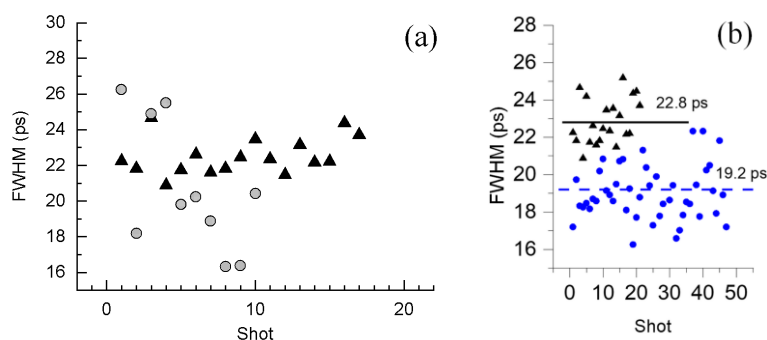


Fig.1. (a) FWHMs of RAEB current pulses recorded with anodes having different hole diameters: 1 (triangles) and 0.1 mm (squares). (b) Variation of FWHM of REAB current pulses from pulse to pulse (triangles - needle cathode, circles - cone cathode). GIN-55-1 generator (rise time of 0.7ns, voltage pulse amplitude of ≈ 78 kV in the idle mode). Air pressure of ≈ 100 kPa.

The shortest RAEB current pulse was observed for a conical cathode (90°) through a 0.1-mm hole in the anode. It was experimentally found that to increase the number of electrons with energies exceeding eU_m , where e is the electron charge and U_m is the maximum voltage across the gap, spherical cathodes should be used. The highest amplitudes of RAEB current pulses were observed in a gas diode with a conical insulator. In addition, the cathode must have an extended edge with a small radius of curvature and must be made of stainless steel.

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