SIMULATION OF THE INFLUENCE OF CATHODE PLASMA ON PLASMA PARAMETERS OF THE TORCH IN THE DIODE GAP OF THE HIGH-CURRENT ELECTRON ACCELERATOR "KALMAR" [[1]](#footnote-1)\*)

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On the Kalmar high-current electron accelerator (current up to 40 kA, voltage up to 350 kV, pulse duration about 100 ns, electron energy in the beam about 0.35 MeV), the features of shock wave propagation in transparent polymeric materials and their destruction under high-power pulsed exposure to a relativistic electron beam (REB) have been explored. In experiments, using a capacitive voltage divider, the total voltage drop was measured, including its inductive component. The beam current was calculated from the measured voltage drop across a low-inductance shunt with a known resistance. The laser shadow streak images of the diode gap and the target were recorded using streak camera. Based on the obtained streak images, the velocity of cathode plasma propagation in the direction from the cathode to the anode was estimated, and estimates of the electron density in the plasma, at which the intensity of the probing laser radiation in the plane of its registration decreases so much that the appearance of a shadow can be detected were also made [1]. The weight of the material carried away from the anode was estimated during the processing of experimental data.

It is difficult to study in an experiment the spatiotemporal distribution of plasma parameters in the diode gap, which is formed by the interaction of two streams: one that expands from the cathode during explosive emission and from the surface of the sample under the action of a high-current REB. The lack of these data can be filled with the help of numerical simulation, which will take into account the data of a specific experiment on the power and duration of the REB, on the electron energy distribution in the beam, as well as the properties of the materials under study. The simulation of the effect of REB on the test sample was carried out using the MARPLE code developed at the Keldysh Institute of Applied Mathematics RAS [2]. The calculations were carried out in the approximation of a one-temperature 3D hydrodynamic model, taking into account thermal conductivity and volumetric energy losses due to bremsstrahlung. The energy contribution of the electron beam was taken into account in the form of a source in the energy balance equation. The calculations were performed using wide-range equations of state of matter. The results of calculations of the entrained mass of the anode material were compared with the results obtained in experiments. This model was supplemented by simulation of the cathode plasma flow. Density and velocity estimates based on experimental data were used in the simulation of the cathode plasma flow.

As a result of this work, calculations were made using experimental data and the results of modeling on the interaction of plasma flows from the anode and cathode in the diode gap of the Kalmar generator of high-current relativistic electron beams were analyzed.

References

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2. V.A. Gasilov, S.V. Dyachenko, A.S. Boldarev, O.G. Olkhovskaya, E.L. Kartasheva, G.A. Bagdasarov, “MARPLE3D application package for simulation of pulsed magnetically accelerated plasma on high-performance computers” , Preprints IPM im. M. V. Keldysh, 2011, 020, 36 p.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Lt/ru/FP-Smirnova.docx) [↑](#footnote-ref-1)