DEPENDENCE OF EFFICIENCY OF IONS ACCELERATION BY AMBIPOLAR FIELD ON DENSITY OF ELECTRONIC CURRENT ON THE GENERATOR REB "KATRAN" [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.162

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In the pulse generators of relativistic electron beams (REB), acting on a transparent load for them, there is a phenomenon of acceleration of ions under the action of the appearing ambipolar field. Ions are accelerated in the direction of a virtual cathode created by relativistic electrons passing through an anode made of a thin foil [1]. With this acceleration, the energy of individual ions can be several times higher than the applied voltage of the pulse generator multiplied by the ion charge. The technology of ambipolar acceleration due to the low cost of equipment and its operation can have a significant advantage over traditional methods, such as cyclic accelerators of charged particles. In the framework of ion acceleration studies, earlier experiments were carried out on the “Kalmar” generator (pulse voltage ~250 kV, current up to 50 kA, pulse duration ~ 100 ns) [2]. The next series of experiments were carried out at the “Katran” generator (pulse voltage ~300 kV, current up to 150 kA, duration ~ 80 ns), where higher current and better focusing of the electron beam are achieved.

The following diagnostic methods were used to study the efficiency of the generation of ion beams of MeV-energies [3]. The energy of individual ions was determined with a time-of-flight technique by measuring the velocity of their movement on a known basis. The calorimetric method was used to measure the total energy of the charged particle beam and the energy density distribution in the beam’s cross-section. The pinhole-camera allowed measuring the REB current density on the anode foil owing to the bremsstrahlung x-ray radiation. In addition to the methods described in the article, a magnetic probe was installed to measure the total current of the ion beam, as well as the possibility of simultaneous use of calorimetric and time-of-flight techniques was provided. Streak camera allowed observing the electron current density on the anode foil not only integrally, but also with time resolution.

During the experiment, it was noted that ions are accelerated by groups with a periodicity of ~ 20 ns. The authors believe this is due to the fact that, until the acceleration of one group of ions is complete, the conditions necessary for the acceleration of the following groups of ions are not yet fulfilled. The dependence of the total energy and energy of individual accelerated ions on the total current and electron current density on the anode foil was also found. The energy of accelerated protons increased significantly, reaching 3 MeV.

The authors are grateful to the Russian Fund for Basic Researches for partial support of research with grants No. 17-02-00441a and No. 18-32-00199mol\_a.

References

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