S1-P-049004

SIMULATION OF A WIDE-APERTURE ELECTRON ACCELERATOR BASED ON ION-ELECTRON EMISSION IN REPETITIVELY PULSED MODE*

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The use of a modern elemental base makes it possible to create discharge power supplies in a repetitively pulsed mode with a pulse repetition rate at the level of a few to tens of kHz. However, due to the complex nature of the dependence of the power output factor on the control parameters, the high potential inherent in the transition from the continuous operation of the accelerator to the repetitively pulsed operation is difficult to study experimentally. The purpose of the work was to develop new and adapt existing numerical models and simulation codes for modeling the repetitively pulsed operation of an accelerator of this type, since such models have not yet been developed. The paper proposes analytical and numerical approaches to modeling the generation of an electron beam in a repetitively pulsed mode of a wide-aperture electron accelerator based on secondary ion-electron emission with a plasma emitter. With the help of well-known codes KOBRA3-INP [1], KARAT [2], xoopic [3] and the developed analytical approach, individual modes of accelerator operation are simulated. Qualitatively, the obtained experimental results are explained, which are in good agreement with the developed approach. Directions for further research and development of diagnostics are proposed.

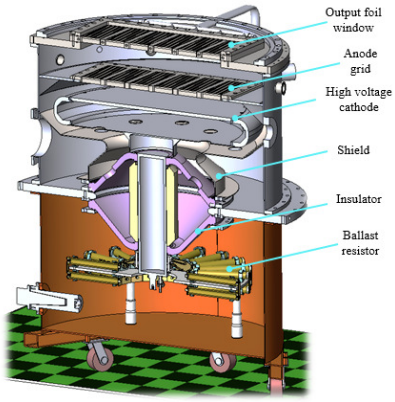

Fig. 1. Design of simulated wide-aperture electron accelerator based on ion-electron emission in repetitively pulsed mode. Electron energy: up to 150 keV, beam current 1–40 mA, current density 1–15 μA/cm^2.

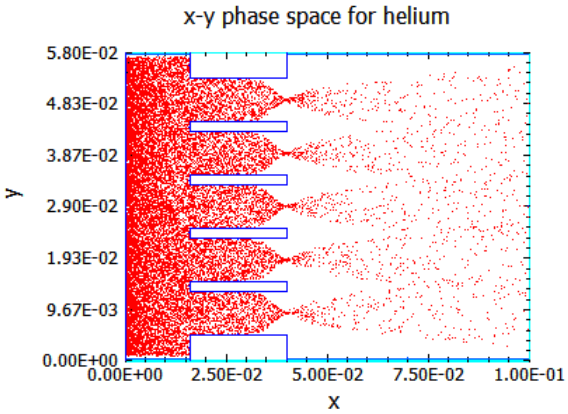

Fig. 2. Distribution of ion particles in the simulation in the five-slit approximation. Modeling with xoopic code.

Figure 1 shows a design of a wide-aperture electron accelerator, on which the experimental part of the work was carried out. Figure 2 shows instant distribution of ions in the computational domain. The computer simulation was done with the xoopic code. The emission boundary is set on the left boundary of the computational domain. The simulation was carried out taking into account the calculated parameters of the auxiliary discharge.

REFERENCES

[1] KOBRA3-INP, INP Wiesbaden, Junkernstr. 99, 65205 Wiebaden, Germany.

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* The work was carried out within the framework of the state assignment of the Ministry of Science and Higher Education of the Russian Federation on the topics FWRM-2021-0007.