

Compact pulsed proton source

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The design and operating principle of a pulsed proton source based on a Penning-type reflective discharge with a cold hollow cathode is described. Gas-discharge systems with a small aperture hollow cathode ensure the formation of inhomogeneous plasma with increased density on the discharge chamber axis and in the emission electrode area, and are characterized by a relatively low discharge voltage. Such a discharge system fully meets the requirements for plasma generators of charged particle beam sources with high current density. The results of studies on the influence of key parameters of the discharge system: working gas pressure, magnetic field induction, geometry of the hollow cathode on the discharge and emission characteristics of the source are presented.

Keywords: ion source, proton source, hollow cathode, reflective discharge, plasma generator.

REFERENCES

1. Forrester A. T., Large Ion Beams: Fundamentals of Generation and Propagation, New York, John Wiley & Sons, Inc., 1988.
2. Mase H., Tanabe T. and Ikahata T., Nucl. Instrum. Methods Phys. Res. B. **37–38** (2), 120–123 (1989).
3. Plasma emitter electron sources / ed. Krindel' Ju. E., Novosibirsk, Nauka, 1983 [in Russian].
4. Kreindel' Ju. E., Plasma electron sources, Moscow, Atomizdat, 1978 [in Russian].
5. Semenov A. P., Sputtering ion beams: production and application, Ulan-Ude, BSC SD RAS, 1999 [in Russian].
6. Gammino S. Proc. of the CAS-CERN Accelerator School: Accelerators for Medical Applications. Vösendorf, 2015, pp. 59–70.
7. Bugaev A. S., Gushenets V. I., Oks E. M. and Shandrikov M. V., Materials. Technologies. Design **5** (12), 7–11 (2023) [in Russian].
8. Kovalsky G. A., Karetnikov D. V., Menshikov M. I., Pleshivtsev N. V. and Shembel B. K., Atomnaja Energija **49** (5), 296–299 (1980) [in Russian].
9. Semashko N. N., Vladimirov A. N., Kuznetsov V. V., Kulygin V. M. and Panasenkov A. A., Fast hydrogen atom injectors, Moscow, Atomizdat, 1981 [in Russian].
10. Semenov A. P. and Batuev B. Sh.-Ch., Zhurnal Tekhnicheskoi Phisiki **62** (10), 171–173 (1990) [in Russian].
11. Galansky V. L., Gruzdev V. A., Osipov I. V. and Rempe N. G., J. Phys. D: Appl. Phys. **27** (5), 953–961 (1994).