Inertial electrostatic plasma confinement chamber as a source of continuous neutron flux with an energy of 14 MeV

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The paper considers an inertial electrostatic plasma confinement (IEC) system based on a gas-discharge chamber with external ion sources. One of the most common applications of IEC is the neutron radiation generation. The paper presents the results of the development of a neutron generator based on an IEC chamber, which consists of a neutron emitter, electronic power and control units, and a cooling system. The generation of neutrons with energies of 14 MeV occurs as a result of DT nuclear fusion reactions occurring in the gas-discharge chamber. The chamber has a spherical geometry with a body diameter of 120 mm using eight ion sources. The results of experimental studies of the generator operation in various modes, studies of the ion sources operation, the influence of the accelerating voltage values, the main discharge current, the ion sources currents and the working gas pressure on the neutron yield and the resulting operating modes are presented. The obtained results made it possible to develop methods for monitoring and adjusting generator parameters to obtain stable operating characteristics. In experiment in a mode with an accelerating voltage of 90 kV, a total discharge current of 6 mA and a temperature of the IEC chamber +40 °C, a stable neutron flux (1.0–1.3)$\cdot 10^8$ neutrons/s was obtained. The experimentally confirmed operating life of the generator in this mode at the time of presentation of the results exceeded few hundreds of hours. In this case, high stability of the generated neutron flux and good reproducibility of the operating mode are observed.