Generation of neutron radiation in an inertial electrostatic plasma confinement tube

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Systems based on inertial electrostatic plasma confinement (IEC) are sources of continuous neutron radiation. The main parameters affecting the level of the generated neutron flux are the discharge ion current, the ion-accelerating voltage at the cathode, the pressure of the working gas in the system, the geometry of the electrodes and their temperature. Most IEC systems studied worldwide are pumped-out designs with cylindrical or spherical geometries of the anode and cathode. Systems of sealed IEC design are of particular interest, as they are simpler to operate and do not require the use of vacuum pumping and gas-filling systems. Furthermore, such systems enable safe operation using tritium. At Dukhov Research Institute of Automatics an IEC tube consisting of a system of cylindrical electrodes, which allows efficient extraction of ions from ion sources and their acceleration towards the cathode to implement nuclear fusion reactions, has been designed.

The operation of individual units of the IEC tube was investigated. An experimental dependence of the generated 14 MeV neutron flux on various parameters, such as the voltage on individual units of the tube and the gas pressure inside it, was obtained. During continuous operation of the tube, lasting approximately 100 hours, stable neutron flux generation at the level of 5×10^7 n/s was achieved.