***PECULIARITIES OF THE FORMATION OF HIGH-INTENSITY ION BEAMS OF GASES, METALS AND SEMICONDUCTOR MATERIALS****

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The work is devoted to the study of some regularities and features of plasma-immersion formation of high-intensity low-energy ion beams of gases, metals and semiconductor materials. It was shown, that repetitively pulsed gas ion beams are sustainably formed both in the system with spherical and cylindrical focusing geometry at negative bias in the range of 0.6–3 kV, pulse repetition rate from units of pulses per second (p.p.s) up to $10^5$ p.p.s, and pulse durations up to 100 μs. The formation of high-intensity metal ion beams requires pre-injection of plasma into the equipotential drift space of the focused beam. The space charge neutralization processes define several features of high-intensity ion beams, including a complex dynamic of focusing and beam instabilities appearing with the increase in beam pulse duration up to 15 μs. The specificity of silicon beam formation is associated with low conductivity of silicon. For the purpose of pulsed vacuum arc plasma generation, the silicon cathodes were neutron transmutation doped on the nuclear reactor of Tomsk Polytechnic University. It was shown, that the process of high-intensity silicon ion beam formation might be accompanied with periodic instabilities of beam transportation and following recovery of space charge neutralization and its transportation. The conditions of sustainable generation of ion beams of gases, metals and semiconductor materials with the current of about 1 A and current densities of 0.5–1 A/cm$^2$ at accelerating voltages of several kV were defined.

*This work was carried out with the financial support of the Russian Ministry of Education and Science within the state assignment "Science" (grants No. 3.2415.2017/4.6 and 3.7245.2017/6.7).