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# DETERMINATION OF ION BEAM ENERGY SPATIAL DISTRIBUTION USING A CALORIMETRIC METHOD WITH A NON-CONTACT TEMPERATURE MEASUREMENT *

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Currently, plasma technologies based on the use of ion beams are being investigated due to the broad prospects of practical application [1-3]. For example, ion beams are used for ion etching, surface properties modification, ion implantation, etc. The development of a method based on the synergy of repetitively-pulsed high-intensity ion implantation and energy impact on the surface [4] requires the development of methods for measuring the dynamic characteristics of the ion beam and thermal fields of the irradiated target. In the case of plasma-immersion formation of submillisecond ion beams of high pulsed power, the problem of non-contact measurement of parameters is especially topical.

The paper deals with the results of experimental determination of ion beam energy spatial distribution using a calorimetric method with a non-contact temperature measurement. The simplified circuit of proposed experimental setup for diagnostic of ion beam showed on the figure 1.

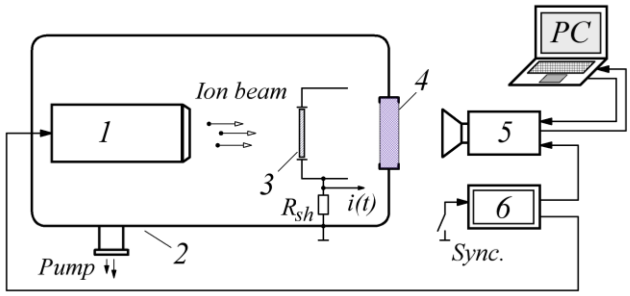


Fig. 1. Simplified circuit of experimental setup for of ion beam energy spatial distribution measurement. 1 – vacuum-arc ion source, 2 – vacuum chamber, 3 – collector, 4 – infrared window, 5 – IR-camera, 6 – synchronization device, Rsh – shunt resistor for beam current flows to the collector measurement.

The ion source 1 based on vacuum-arc discharge is described in detail in [4,5]. The ballistically focused beam of titanium ions with an energy up to 30 keV and pulse duration about 300 μs was directed at the collector 4 made from thin titanium foil. The temporal evolution of collector surface temperature (thermogram) measured by the infrared camera 5. As a result of the interpretation of the data obtained during the IR camera image processing the temperature rise of the collector surface was measured. Then knowing an collector thermal properties is able to estimate ion beam energy spatial distribution by using the calorimetric method. The shunt resistor and oscilloscope are used for beam current flows to the collector measurement. In the experiments, the thermogram of the ion beam trace on the collector surface has been obtained. It is shown that at an accelerating voltage of 30 kV a diameter of beam thermal trace on the collector is 5...7 mm and an energy density reaches 2.7 J/cm$^2$.

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