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INVESTIGATION OF THE TARGET HEATING UNDER THE COLD PLASMA JET INFLUENCE *

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Currently, the field of medicine investigating the plasma formations influence on biological targets is actively developing. In most biomedical investigations conducted to study the effects caused by the plasma influence on biological targets, a cold plasma jets sources of atmospheric pressure are used [1]. The plasma jet is a sequence of streamers that are initiated by applying, for example, a sinusoidal voltage to the electrodes and propagating along the gas flow. Increasing the plasma jet power makes it possible to improve the efficiency of the plasma jet interaction with biological targets, since an increase in the energy contribution leads to an acceleration of plasma-chemical reactions [2]. In this case, heating of living tissues occurs, which can cause local burns and, subsequently, the destruction of protein compounds in cells. The investigation of the heating temperature of the target under the action of a cold plasma jet was made. A ceramic Al_2O_3 plate placed on a grounded electrode was used as a target, and the temperature in the interaction area with the jet was measured. It is shown that in certain operation modes the target temperature can exceed 50 ℃, which is unacceptable for affecting biological objects (for example, T = 60 ℃ at υ = 9 L/min, f = 13 kHz, U = 6 kV).

Comparative studies of target heating under various conditions under the action of a plasma jet were carried out: generation of a plasma jet in helium *He* with preliminary gas cooling (Fig. 1*a*, f = 13 kHz); generation of a plasma jet in a gas mixture of helium *He* and oxygen *O* (Fig. 1*b* helium flow rate *He* υ = 9 L/min, f = 13 kHz); generation of a plasma jet with limited current pulse duration (f = 25 kHz, υ = 4.5 L/min).

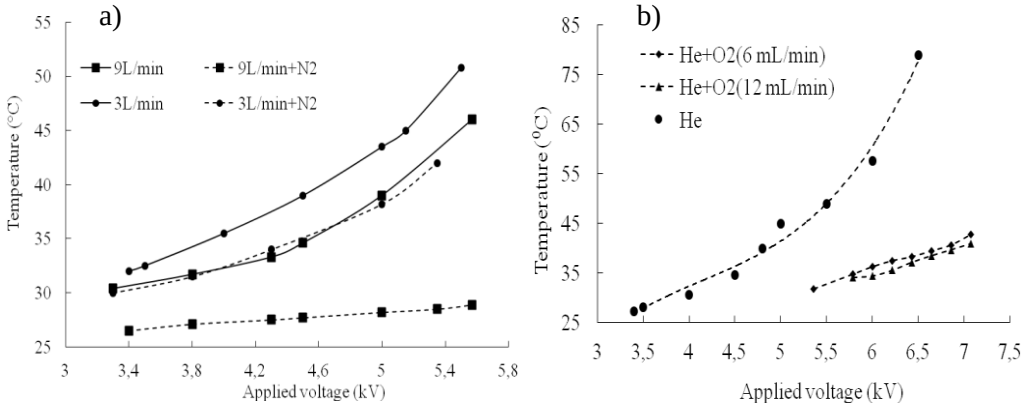

Fig.1. Reduction of target heating in the interaction zone.

Lowering the target temperature with the use of preliminary cooling of the gas pumped through the gas-discharge cell makes it possible to lower the temperature in the interaction zone to ~43%. An increase in the concentration of oxygen-containing radicals leads to a significant decrease in target heating. The effect was also observed with an increase in the rate of oxygen O_2 pumping through the gas-discharge cell. The oxygen O_2 supply into the body of the gas-discharge cell at a rate of 1.5-9 mL/min with helium *He* υ = 3-12 L/min makes it possible to reduce surface heating by ~25–50% under other comparable exposure conditions. The current pulse duration is one of the main factors affecting the temperature in the area where the plasma jet affects the target. By limiting the pulse duration, the target temperature decreased by ~20%.

Thus, the application of the developed techniques for reducing target heating makes it possible to use high-energy operation modes in biomedical research.

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