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# INVESTIGATION OF COLD PLASMA JET GENERATION PROCESS UNDER EXCITATION BY UNIPOLAR POSITIVE PULSES *

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A modern trend in the development of plasma medicine is the impact of plasma formations, in particular atmospheric pressure plasma jets, on biological targets of various nature. In the area of plasma structure distribution and the interaction area with the target, charged particles cause chemical reactions. As a result, there is an increase in the radical concentration containing oxygen and nitrogen, which affects the current processes inside the cells [1].

The course of chemical reactions in the interaction area with biological targets depends on the contact frequency of the surface with a plasma jet. Earlier, in [2], it was shown that each positive half-cycle of the applied sinusoidal voltage initiates a streamer inside the dielectric channel, but outside the discharge zone, the streamer propagation is prevented by the bulk plasma formation accumulated from previous cycles. Such phenomena depend on the conditions in the nozzle–target gap and is determined by the ratio of the plasma density formed in the streamer head and the residual plasma density above the target surface. Thus, the current frequency reaching the target $f_I$ does not coincide with the frequency of the applied voltage $f_U$.

In the present work, the plasma jet generation upon excitation by unipolar positive pulses at frequency $f_U$ = 1-40 kHz, applied amplitude voltage 2-6 kV was studied. The operation modes of a plasma jet excited by unipolar positive pulses were studied and determined modes, which provided the coincidence of the current contact frequency $f_I$ and the frequency of the applied voltage $f_U$. The fundamental difference between the excitation nature of the discharge by pulsed or sinusoidal voltages was the time of the voltage rise $\tau$. With pulsed excitation, the rise time was $\tau$ = 3 μs; with sinusoidal excitation was $\tau$ = 5 μs. The investigation of plasma jet generation upon excitation by unipolar positive pulses with different leading edge durations $\tau$ = 3 μs (Fig. 1*a*) and $\tau$ = 10 μs (Fig. 1*b*) demonstrated that excitation by pulses with a leading edge $\tau$ = 3 μs ($f_U \approx$ 22 kHz, $U$ = 5 kV) provides the condition for the frequency ratio $f_I = f_U$, and at $\tau$ = 10 μs ($f_U \approx$ 22 kHz, $U$ = 5 kV) the frequency ratio is $f_I = f_U/2$.

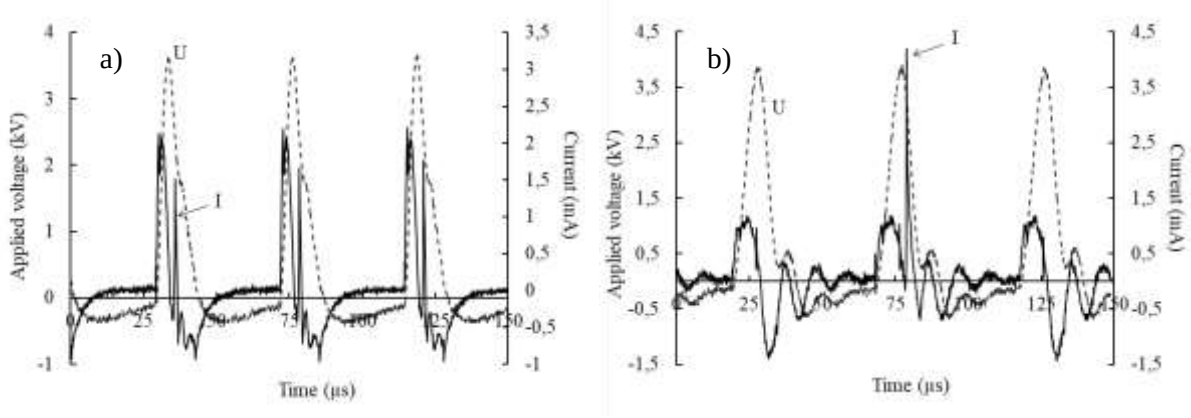


Fig.1. Oscillogram of current and voltage with different duration of the leading edge

## REFERENCES

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