ROLE OF THE APPLIed VOLTAGE shape ON THE FORMATION Of PARAMETERS of DIELECTRIC BARRIER MICROdischARGE IN ARGON

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Dielectric barrier glow discharges have been known for a long time. However, in recent years there has been a new surge in intensive studies of the characteristics of dielectric barrier discharges. This is due to the fact that barrier dielectric discharges find a wide range of applications in pressures at atmospheric pressure, from plasma aerodynamics to the decomposition of gaseous substances in plasma and plasma medicine. At the same time, the search for ways to control the parameters of the barrier microdischarge, expanding the ranges of its operation is of practical importance. In addition to changing the frequency and amplitude of the supply voltage, experimental studies on the influence of the shape of the supply voltage on the discharge characteristics [1] are gaining more popularity. The publications devoted to the numerical analysis of the influence of the form of the supply voltage on the spatial-temporal characteristics “can be counted on fingers” [2].

In the present work, in the framework of a one-dimensional extended fluid model, numerical experiments were performed to study the dielectric barrier discharge of atmospheric pressure in argon in a wide range of input conditions. The main types of supply voltage are considered: sinusoidal, triangular, square ("meander") and sawtooth.

Numerical simulations have been carried out for sinusoidal, triangular, square ("meander") and sawtooth.feeding voltages in a wide range of external conditions. In particular, the spatiotemporal behavior of the charged particle densities; the strength and potential of the electric field; and the time dependences of the discharge current, the voltage drop across the discharge gap, and the charge accumulated on the right and left dielectric barriers have been calculated. It is shown that the spatiotemporal characteristics of an atmospheric-pressure dielectric barrier microdischarge in argon depend on the shape of the applied voltage. For a square feeding voltage, two current pulses are always observed during one period, regardless of the voltage amplitude. For a sinusoidal and triangular feeding voltage, the number of current pulses per period increases with increasing voltage amplitude. A sawtooth signal demonstrates a combination of single and multiple current pulses on steep and gentle slopes of a signal, respectively. This indicates that the spatiotemporal characteristics of the DBD plasma differ significantly for different shapes of the feeding voltage, the other conditions being the same.

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References

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