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CURRENT CHARACTERISTICS OF NANOSECOND SURFACE DISCHARGE IN AIRFLOWS *)

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Discharges in high-speed flows have been studied over the past decades within the framework of plasma aerodynamics [1, 2]. The aim of this study was to investigate the characteristics of the current in a surface sliding discharge in stationary air and in supersonic flows with an oblique shock wave [2].

In the discharge chamber of the shock tube [2], a sliding surface discharge was formed by applying a pulsed voltage of 25 kV to a discharge gap 30 mm wide and 100 mm long in the direction of the flow. The discharge current was recorded using a low-inductance shunt in stationary air at a pressure of 5-150 Torr and in supersonic flows with Mach numbers of 1.16-1.62. In flows with an oblique shock wave, the discharge current flows in a single high-intensity current channel [2].

Current oscillograms under various conditions demonstrate an oscillatory nature. With an increase in the density of the medium, the amplitude of the current decreases, and its attenuation increases (Fig. 1a). In the process of decomposing current oscillograms into harmonics, a reduction in the amplitude A_1 of the main harmonic (~5 MHz) was noted as the medium density increased (Fig. 1b). A comparison of the oscillograms and their harmonic decompositions in stationary air and in flows revealed that at the same medium density, they differ in the harmonic ratio. An additional second harmonic A_2 with a frequency of ~7.3 MHz is distinguished in the flow current oscillograms. All oscillograms feature a clearly defined third harmonic A_3 of lower amplitude with a frequency of ~17.5 MHz.

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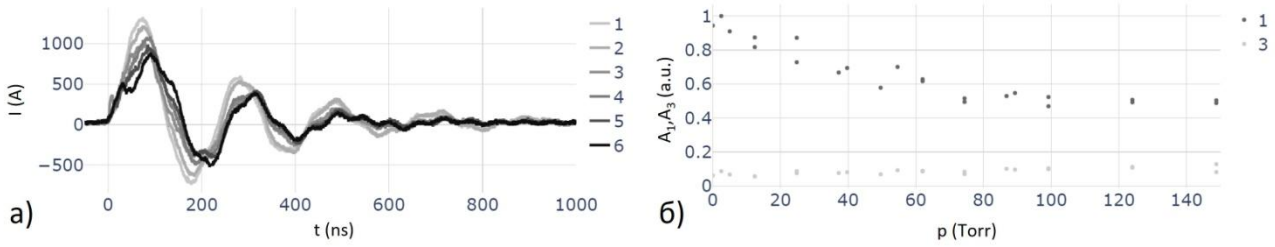

Fig. 1. a) current oscillograms for stationary air at pressure: 1 - 5 Torr, 2 - 25, 3 - 50, 4 - 62, 5 - 99, 6 - 149; b) amplitudes of the main A_1 and third A_3 current harmonics depending on the pressure in stationary air.

References

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*) abstracts of this report in Russian