Dynamics of a pulsed plasma interacting with a plane shock wave [[1]](#footnote-1)\*)

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The results of an experimental study of the motion of a plane shock wave in a relaxing plasma of a nanosecond volume discharge in a shock tube (Mach numbers of shock waves 2.2-4.0) are presented. The dynamics of the shock front motion in the plasma volume was studied and matched with the relaxation of the plasma. The results obtained can be used to shock wave control using pulsed discharges.

The experiments were carried out on a shock tube with a discharge chamber, in which a combined volume discharge was initiated in a volume of 100 - 30 - 24 mm3 at a pulse voltage of 25 kV [1, 2]. The discharge current reached 1 kA, its duration was ~500 ns. The discharge current and radiation were analyzed. The dynamics of the shock wave front movement was examined at the post-discharge stage. The emission spectra were used to estimate the concentration and energy of electrons in the plasma volume, and the strength of the electric field.

The discharge current passes in front of the shock wave when it is in the discharge volume [1, 2]. The radiation intensity of the discharge interacting with the shock wave correlates with the discharge current oscillations. The total duration of the glow (~ 1600 ns) is much longer than the duration of the discharge current [1]. The dissociative recombination time is ~ 10 ns under the experimental conditions. Afterglow of molecular nitrogen can explain the prolonged radiation near the shock front [1]. A change in the state of the gas in the discharge current volume leads to the decay of the gas-dynamic discontinuity at the interface "the front of the initial shock wave - plasma" [2, 3]. Two shock waves moving in opposite directions and a contact surface are formed. One of the shock waves moves over the relaxing plasma, compressing it and generating a long afterglow [1, 2]. High-speed shadowgraphy of the flow field in the channel with a frequency of up to 525,000 frames per second made it possible to visualize the motion of the generated waves. Digital processing of sequences of shadowgraph images revealed the temporal features of the motion of the front of the shock wave in the plasma region and showed that the dynamics of the shock wave depends on the initial parameters of the plasma and the recombination/relaxation processes.

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