Stabilization of combustion front in supersonic flow using streamer's discharge

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Thermodynamic analysis shows that for flight with velocity exceeding Mach 6, it is required to burn fuel not in a subsonic but in a supersonic flow. In this paper, one of the possible methods to create a stationary combustion front in a supersonic flow is studied. This method is based on ignition of the mixture by an attached microwave discharge. Discharges are created on the resonator by means of a pulsed source of quasi-optical microwave radiation. Completed in the past 20 years in the Moscow Radiotechnical Institute of the Russian Academy of Sciences, detailed studies of such discharges have shown that the above-mentioned method exceeds by one or two orders from the point of view of energy costs other methods, including corona discharge and spark ignition. At the same time, the electric field strength required to create a discharge is much less than the critical field of air breakdown, i.e. discharges are subcritical.

In the current work, a semiempirical and numerical simulation of the development of a subcritical streamer discharge attached to the surface of a dielectric and a deep subcritical diffusion discharge is performed. Calculations have shown that the speed of propagtion of streamers is several km / s, so they are not blown off by a supersonic flow. Similar calculations for the diffuse discharge demonstrate that the discharge is not blown away by the flow, at least up to a speed of 1 km / s. Experiments have been conducted to ignite the flow of a mixture of propane with air by various discharges at speeds up to twice the speed of sound. In all cases, the experiments confirmed a steady burning of the fuel, which was monitored by measuring the temperature and the braking pressure. Baltic State Technical University "Voenmeh"

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