Impingement of the hot supersonic jet on the barrier near the nozzle exit

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The purpose of the research was to do the experimental study of the overexpanded hot supersonic jet of the small thrust model engine on gaseous oxygen / kerosene fuel components flowing into a flooded space at atmospheric pressure. The jet parameters were varied by changing the mass ratio oxygen/kerosene K_m. The nozzle exit specific heat ratio was in the range from 1.2 to 1.3, and the jet stagnation temperature was in the range from 1528 K to 2764 K. The flat plate with 450 inclination was placed ahead the first Mach disk and involved the jet periphery region. The heat flow and pressure sensors were installed on the plate. The visualization of the jet and the zone of interaction with the plate were hampered by the radiating carbon particles, which were formed during combustion. The track directions in the molten material on the plate surface formed at the hot jet impinging were used to build the flow pattern. The destruction zones and material tracks coincidence for all flat plates indicates the steadiness of the hanging shock waves location with the jet parameters varying in the range of K_m = 0.99…1.58. The study suggests a method for calculating heat fluxes in the central part of the jet on real components, using thermodynamic parameters calculated for an equilibrium reacting mixture, the method being satisfactorily consistent with the measurements carried out. High heat fluxes were obtained in the jet periphery region not only due to the jet mixing boundary layer impingement but because of the particular ejection of the hot gas from center region. Measurements in jet peripheries region are the subjects for the following investigations. The studies will be continued with larger nozzle.

***Keywords**: supersonic jet, pressure, heat flux, mixing zone, impingement on flat plate, pressure ratio*

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