

TESTS OF THE PULSED-DETONATION RAMJET MODEL IN A FREE AIR JET WITH MACH NUMBER UP TO 0.85

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Abstract: Firing tests of the pulsed-detonation ramjet models equipped with mechanical and gasdynamic check valves were conducted in free subsonic air jets with a Mach number ranging from 0.65 to 0.85. The fuel used was liquid propane. At operation of the ramjet model with a mechanical valve at a frequency of up to 10 Hz, the average thrust of up to 30 N, and the average fuel-based specific impulse of up to 1000 s were demonstrated. At operation of the ramjet model with a gasdynamic valve at a frequency of up to 20 Hz, the average thrust of up to 10 N, and the average fuel-based specific impulse of up to 130 s were demonstrated. The instantaneous values of thrust and specific impulse, determined by averaging over each operating cycle, were significantly higher if detonative rather than deflagrative combustion occurred in the cycle. The ramjet model with a mechanical valve proved to be much more efficient than the model with a gasdynamic valve. The low efficiency of gasdynamic valves is explained by their poor capability of decelerating the flow of combustion products displaced from the ignition chamber through the model intake under the action of high overpressures.

Keywords: pulsed-detonation ramjet; mechanical valve; gasdynamic valve; subsonic wind tunnel; thrust; fuel-based specific impulse

Acknowledgments

This work was supported by the Russian Science Foundation (grant No. 14-13-00082P).

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Received June 19, 2017

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