EXPERIMENTAL STUDIES OF STAND SAMPLE OF ROCKET ENGINE WITH CONTINUOUS-DETONATION COMBUSTION OF NATURAL GAS – OXYGEN MIXTURE

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Abstract: The effect of structural elements and parameters of fuel (natural gas (NG) and oxygen) supply on thrust performances of the liquid propellant rocket engine with continuous-detonation combustor has been investigated experimentally. In the tests, the absolute pressures of NG (up to 30 atm) and oxygen (up to 15 atm) supply, fuel mixture mass flow rate (from 0.05 to 0.7 kg/s), and mixture equivalence ratio (from fuel-lean, $\Phi = 0.5$, to fuel-rich, $\Phi = 2.0$) were varied. The maximum thrust and specific impulse obtained in the tests were 75 kgf and 160 s, respectively, at an average pressure in the combustor of about 10 atm. The increase in the combustor pressure led the thrust and specific impulse to gradually increase. The increase of the specific mass flow rate of fuel components through the combustor led, on the one hand, to a more stable operation process and, on the other hand, to a larger number of detonation waves continuously rotating in the annular combustor. Replacement of a flow washer by a shaped nozzle at the combustor outlet at other similar conditions led to the increase in engine thrust and to a substantial decrease in the detonation velocity (from 2200 down to 1500 m/s), approaching the limiting value.

Keywords: continuous-detonation combustor; liquid propellant rocket engine; natural gas; oxygen; experiment; thrust; specific impulse

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