SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Systems I (1)

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ROCKET PROPULSION USING UNITARY PASTE-LIKE PROPELLANT. EXPERIMENTAL INVESTIGATIONS OF PASTE-LIKE PROPELLANT AND RESULTS OF PRM FIRE TESTS

Abstract

The development of Paste Rocket Motor (PRM) with coercive feeding of propellant to combustion chamber with possibility of deep throttling and multiple starting requires very detailed investigations of the features of the motor design and working processes at such PRMs. During the development of the motor several types of propellant were made and tested. Also the Laboratory has developed several types of the PRM with thrusts within 200-2200N with possibility of deep throttling and multiple starting. The complex of calculating, manufacturing and testing works was conducted that confirmed physical possibility of creation of the PRM and its usability. To confirm the basing project technical solutions the PRM with thrust around 2200N was developed, manufactured and tested. The experimental program for the motor foreseen cold and fire of the propellant and full completed PRM. During the tests we conducted investigations for the propellant of different receipts: propellant 'spillage' over single element of extruder unit, determined the propellant consumption, its rheological dynamics and physic-chemical characteristics. The PRM was studied on hermiticity and durability, capacity for work of separated elements and full motor, its efficiency with the use of high-, low- and experimental paste propellant compositions. After cold tests we conducted a range of fire tests. The exploitation characteristics were investigated: rate of combustion, shock loads, electric discharge, etc. The investigations demonstrated the selected base receipts of low-temperature (up to 2000K) and high-temperature (up to 3000K) propellant should have attention as a dangerous matter of 1st class (subclass 1.3). The fire tests were started from autonomous work of gas-generators using solid ballistic propellant. The fire test program foreseen the works on different regimes: start, coming to nominal regime, throttling of different depths, switch-off, repeated start and repeated coming to nominal regime. The conducted experimental investigations of the propellant and PRM confirmed the rightness of the project solutions and technical parameters, and also capability for work of the PRM.