SPACE PROPULSION SYMPOSIUM (C4)
Propulsion System (1) (1)

Author: Mr. Chnagguo Liu
China

Ms. HongLing Zhou
China

THE DEVELOPMENT AND QUALIFICATION TESTING OF THE SECOND GENERATION HIGH PERFORMANCE 490N LIQUID APOGEE ENGINE

Abstract

The 490N Liquid Apogee Engine(LAE) is used to provide the thrust for apogee injection maneuver or other maneuver required for the spacecraft planned mission. The Chinese first generation 490N LAEmodel FY–25was developed successfully by Shanghai Institute of Space Propulsion(SISP) in Apr. 1990. Its specific impulse is 2990N•s/kg(305s) at a nozzle area ratio of 154:1 and chamber pressure of 0.68MPa. It has hitherto been flied on 33 satellites with 100 percent successfully, including 8 DFH-4 platform and 25 DFH-3 platform satellites. In order to satisfy the requirement of Chinese new generation satellites of large capacity, long-life and high reliability, SISP began to develop the second generation high performance 490N LAE in Sep. 2001, model TQS492-2. The aim of the second generation 490N LAE is to increase the specific impulse from 305s to 315s. The pre-research program was started in 2001 and the engineering type development was processed in Jan. 2006. In Aug. 2010, the development and qualification tests of the engine was finished and shifted to manufacture phase for batch. The second generation engine uses MON-1 as oxidizer and MMH as fuel, which are the same as the first generation, the designed nozzle expansion ratio is 220:1 and the inlet pressure is 1.5MPa. During the development phase, several critical technologies have been broke through, such as high performance injector, high temperature oxidation-resistant thruster materials, head flange and combustion chamber wall temperature controlling, structure withstanding higher vibration level and thermal heat shield. The specific impulse of 3090 N•s/kg(315s) was achieved. Up to now, 10 unit products passed qualification test, including random sinusoidal vibration and high altitude simulation test with more than 25 000 seconds firing time. In Jan. 2011, No. 01 batch products were accomplished; the qualification and acceptance tests were finished. In Apr. 2011, the first flight unit for one DFH-4 platform satellite was delivered. It will fly in May of this year. In Jan.2012, another flight unit was delivered. The other three units will be delivered this year in succession. The design and the performance of the second generation TQS492-2 490N LAE, especially the main measures to increase the specific impulse were introduced in detail. The qualification test results and first flight results are then described.