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LATEST PROGRESS OF HIGH PERFORMANCE LIQUID APOGEE ENGINE FOR SATELLITES IN
SISP

Abstract

The Liquid Apogee Engine(LAE) is used to provide the thrust for apogee injection or other maneuver required for the spacecraft planned mission. Shanghai Institute of Space Propulsion(SISP) is the current sole supplier of LAE used on the 3-axis stabilized geostationary satellites of China, flight products include the first generation 490N LAE(Isp is 305s) and the second generation high performance 490N LAE(Isp exceeds 315s), developmental products include the third generation high performance 490N LAE(Isp exceeds 325s) and the high thrust and high performance 750N LAE(Isp reaches 325s). Up to now, the first generation 490 LAE has hitherto been flied on 46 satellites and has been stopped producing in 2010; the second generation high performance 490N LAE flied on 16 satellites, one of them didn't work because the failure injection of the satellite lunched by CZ-5 Y2 on July 2, 2017. This paper introduces the latest progress of above four LAEs, the 15 satellites flight results of the second generation 490N LAE are presented particularly. All of these four LAEs, the qualification high altitude simulation test burning time is more than 25000 seconds. the temperature of the combustion chamber of the third generation 490N LAE reaches 1700 1800degree, so this LAE adopts rhenium/iridium material; the rest three LAEs use mature technology of niobium hafnium or niobium tungsten alloys and high temperature anti-oxidation coatings for the low temperature of the combustion chamber under 1400degree. In order to meet the requirements of the larger and high reliability satellites, the qualification hot firing test burn times are extended from 25000 seconds to 33000 seconds, several engines were carried out this hot firing test. The test results show that the life of the second generation 490N LAE can reach 40000 seconds with no failure under the standard running conditions of 490N nominal thrust and 1.65 nominal mixture ratio, but the life was seriously affected and the throat of the combustion chamber burned out an hole under the high running conditions of high thrust and high mixture ratio. The head flange temperature were measured by thermal resistance, the 13 second generation 490N LAE fitted in the same state flight results indicate that statistical result of the head flange temperature is about 76degree, the head flange temperature increased over time, but increased more and more slowly. When the engine was shut down , the temperature raised to about 123degree 600 seconds later because of the thermal soakout.