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THE DESIGN AND TEST OF 1N THRUSTER WITH HAN-BASED PROPELLANT

Abstract

MicroSats and NanoSats have seen unprecedented growth in recent years, but many of these tiny satellites will fly without any form of propulsion, it is believed that developers will be amenable to use green monopropellant propulsion for extending mission life and thus saving asset replacement costs and range safety concerns. The attempt of replacing toxic propellant hydrazine by green propellant has attracted the relevant industry worldwide. HAN-based propellants have emerged as good alternatives to replace the hydrazine propellant because of their relatively lower toxicity, higher density, lower freezing point and higher specific impulses compared to hydrazine, and a lot of papers have reported the achievements in small thrust class like 0.5N, 1N by using HAN-based propellants. Shanghai Institute of Space Propulsion (SISP) has been focusing on the novel technology since the late 1990's and developing different thrust level of thrusters using HAN-based propellant named as SH132, which is a blend of HAN, water, fuel and other additives, and its density is 1.3g/cm³, SISP's efforts of these years have yielded substantial progress in the development of the thruster design, analysis and test technology, and the most important advances have been achieved on 1N thruster recently. It now has achieved an accumulated 14300s firing time, 51000 pulses and 1000s longest continuous firing time with catalyst bed temperature preheated to 200. It delivers a specific impulse performance of 215s (with 100:1 expansion ratio nozzle) and the highest temperature of the thruster obtained is no more than 1100 during thruster operations in vacuum conditions, and the propellant throughput of the 1N thruster is 10kg. SISP has developed a fully functional propulsion system, incorporating a complete set of SH132-compatible components ready for deployment on a wide range of missions. The achievements of 1N thruster are the results of comprehensive development of propellant formulations, catalyst and thruster design. This paper gives an overview presentation of the research. With all assembly and integration of the flight green propulsion system payload have been completed, the launch preparations for its first flight demonstration on early year of 2018, and the signals indicate that the satellite works well.