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PULSED RESISTOJET THRUSTER WITH POWER DELIVERY SYSTEM BASED ON SUPERCAPACITORS

Abstract

A resistojet has been well known thruster since the beginning of satellite technology, however its capabilities are limited by some technical issues like: heat transfer limitations, thermal losses, high power consumptions and many others. During last four years a new type of resistojet has been developed. The main innovation is use of dedicated power supply unit where the energy is stored in bank of supercapacitors. This solution allowed obtaining high peak power consumption with very limited mean consumption from satellite power system. Due to novel very light design of the heater, recuperation of the heat and periodic mode of work, the resistojet does not need a heavy insulation. This work will presents new results for the new type of resistojet propelled by argon and nitrogen. The choice of the gases is caused by some specific application. If the thruster is used in service mission to a satellite it can be important to avoid any contamination of the sensors (including optics) by the plumes of the reactive gases. Example of such mission is the project SatService, where the geostationary satellite is serviced by another spacecraft in order to extend the lifetime of the mission. Another example is a repair of a space telescope in the orbit. If one consider the problem of interaction of the service spacecraft and the serviced satellite the noble gases like argon seems to be a good choice. Additionally the argon is usually used in cold gas systems. Therefore it allows easy combination of the cold gas thrusters with much more effective resistojets. The work will presents the experimental results of test of the novel resistojet propelled by argon. As the a reference gas ammonia will be used because it was the main propellant used in the first phase of the development of this kind of the resistojet. The work will presents such parameters like the trust, mass flow rate, specific impulse, temperature of the working gas, power consumption etc. The results show that use of argon and the novel resistojet allows design of very flexible and effective system of attitude control. Comparing to the cold gas system it should reduce significantly the gas consumption. Comparing to the chemical thruster it simplifies the design. Due to pulse operation and supercapacitors it does not create a need for redesign of power system while the response time of the propulsion system remains very low.