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LIQUEFIED GAS THRUSTER WITH RING MECHANISM FOR NANOSATELLITE PROPULSION

Abstract

Considering the huge transformation of the nanosatellite industry into a commercially viable one, a propulsion system is of prime importance onboard a satellite for various operations in space. A liquefied Gas Thruster, developed by VACCO Industries is the most promising alternative for the same. It utilizes the high vapour of the propellant, such as butane or alcohol, which can be stored as liquid, then upon expansion, phase transfer into a gas. This allows the propellant to be stored at a much lower pressure compared to a pressurized gas such as nitrogen. The main advantage however, is the higher density of a liquid versus a gas allowing much more propellant to be stored in a given volume. Liquefied gas thrusters generally consist of a liquid propellant tank and an adjacent plenum tank where the propellant vaporizes, allowing the vapor to travel to the valves followed by expulsion through exit nozzles. In this paper, instead of the propellant tank, we propose the use of ring(s) for the storage as well as transfer of the propellant. The ring(s) would be shifted downwards towards the high pressure chamber, where the phase transformed and expanded propellant would be transferred using valves. A heater would be placed to increase the temperature of the propellant inside the ring and hence expand it. This mechanism can provide better efficiency and management of space weight onboard a satellite. Also, it has been experimentally validated that the liquefied gas thruster can provide sufficiently high values of thrust (approx 55 MN for a 40 psi pressure chamber).