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DEVELOPMENT OF 10N MARK-2 THRUSTER FOR SPACECRAFT APPLICATIONS

Abstract

Abstract The 10N bipropellant Thruster is used for attitude and orbit control for Geostationary satellites. Liquid Propulsion Systems Centre (LPSC) of Indian Space Research Organisation (ISRO) has developed and qualified 10N thruster (mark-1 version) and it has been successfully used in twenty four spacecraft missions. The propellant combination employed is nitrogen tetroxide (oxidizer) mono methyl hydrazine (fuel) at a mixture ratio of 1.650.05. The thruster with an area ratio of 200 delivers a thrust of 10N with a specific impulse (ISP) of 285s (minimum). This thruster uses a single element coaxial swirl injector made of Titanium alloy. The thrust chamber is made of silicide coated columbium alloy and is electron beam welded to the injector. Latchable series redundant valves are used as flow control valve. The chamber cooling is by radiation supplemented by film cooling by virtue of inherent design of the injector. The existing version thruster has bi-stable chamber temperature stabilization at lower injection pressures even though it is within permissible operating temperature of the material. Also deposition of carbonaceous particles on the injector face is observed in this configuration as the fuel is flowing through the outer swirl passage and oxidiser through the inner swirl passage. In the mark-2 thruster, refinements in the injector were attempted by reversing the flow with oxidizer through the outer passage and fuel through the inner as well as optimizing the spray cone angles which could overcome the shortcomings mentioned before. High altitude version thrusters were realized and qualified and the improved version is being inducted to spacecraft applications. This paper presents the details of the 10 N mark-2 thruster.