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SPACE PROPULSION SYMPOSIUM (C4)
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HYPERGOLIC GREEN PROPELLANTS BASED ON THE HTP FOR A FUTURE NEXT-GENERATION SATELLITE PLATFORMS

Abstract

New, alternative approach to the space hypergolic propellants to be used on the next-generation satellite platforms for the ACS systems or to orbit transfers has been analyzed. The main purpose of this study is comprehensive benefits evaluation of the performance, storability and handling issues of the new green hypergolic propellants based on the highly concentrated hydrogen peroxide, 98%+ of HTP class. Recently, new green propellants combinations for the spacecrafts based on the ADN and HAN – that is LMP-103S, FLP-106 and AF-M315E, respectively – have been introduced for satellite space tests. Nonetheless, hydrogen peroxide of HTP class can be used widely, not only in monopropellant but also in bipropellant thrusters, especially in hypergolic configuration. The medium (e.g. 98%+ HTP) in contact with some organic liquids can be hypergolic, with reliable ignition that results with IDT on the level of 10-20ms – depending on the amount and activity of the catalyst additives. Additionally, performance of such propellant compositions can be similar to the currently used toxic ones or even higher. Taking into account the fact that the Institute of Aviation has at least 7 years of experience in preparation, storage, handling and testing of hydrogen peroxide of HTP class – mainly as 98%+ in the rocket propulsion demonstrators, this study provides some practical guides within these issues. The second goal of this study is to present a concept design of the satellite platforms for the commercial or scientific objectives propelled by hypergolic green propellant based on HTP as an oxidizer. This design include analyses of the pressurized feed system, propulsion units, masses and sizes evaluation with 3D visualization of the satellite concept. The proposed pressurized feed system is typical for the small and medium satellites and bases on the spherical tanks with helium. The proposed propulsion system of the bipropellant hypergolic concept may be used for the apogee rocket engine and/or ACS thrusters as well. Due to the fact that such propellant combination exhibit higher density specific impulse than the toxic compositions such as hydrazine with MON-1,2,3 or NTO, the propulsion based on 98%+ HTP can be successfully used for many various missions of the future spacecrafts. Moreover, the utilization of the hydrogen peroxide of the highest grade in space sector can significantly decrease the total cost of the satellites missions, due to the low toxicity, high stability, long duration storability and safety of the medium.