Advanced Monopropellants Combustion Chambers and Monolithic Catalyst for Small Satellites Propulsion

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The reality of emerging threats to the United States requires the rapid deployment of new satellites to meet Department of Defense space capability needs [1, 2]. It is desired to develop an advanced propulsion system for small, low cost satellites which provides high-velocity changes and rapid control. Current state-of-the-art monopropellant thrusters use unstable, volatile, highly toxic and carcinogenic, hydrazine-based fuels. Advanced “green” monopropellants promise significant improvements over current hydrazine propellants, because of lower toxicity, higher chemical stability, and increased performance. Despite current progress in advanced monopropellant technology based on energetic ionic liquids (HAN, HEHN, TEAN and ADN), their application in small chemical propulsion requires development of combustion chambers able to withstand a highly aggressive environment and provide a stable and reliable ignition source. A flight weight, high-temperature, iridium/rhenium combustion chambers were manufactured at Plasma Processes for ADN based monopropellant thruster using innovative EL-Form™ technology. The thrusters were successfully tested and currently are flown onboard Swedish satellite “Prisma”. Oxidation resistance combustion chamber and monolithic catalyst for HAN based AF-M315E monopropellant is being developed at Plasma Processes, LLC in cooperation with Dynetics, Inc. The oxidation resistant iridium/rhenium/iridium 4 lbf thrust chamber and metal foam based monolithic catalyst support were developed and fabricated using electrodeposition from molten salts technique. The developed thruster and catalyst were tested using AFM-315E monopropellant. The ignition and combustion of AFM-315E was demonstrated. The results of the development, manufacturing and testing of the oxidation resistant combustion chambers and monolithic catalyst will be presented.

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