

Design and Development of Hydrogen Peroxide Monopropellant Thruster: Basic Theory and Performance Ca

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DESIGN AND DEVELOPMENT OF A HYDROGEN-PEROXIDE ROCKET-ENGINE FACILITY

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ABSTRACT

The ongoing developmental studies on the application of hydrogen peroxide for propulsion are briefly reviewed. A detailed design-study of a laboratory scale hydrogen peroxide mono-propellant engine of 100 N thrust is presented. For the preparation of concentrated hydrogen peroxide, a distillation facility has been realised. Results of water analogy tests are presented. Initial firings using the concentrated hydrogen peroxide were not successful. Low environmental temperature, low contact area of the catalyst pack, and contamination in the hydrogen peroxide were considered to be the reasons. Addressing the first two points resulted in successful firing of the rocket engine.

Keywords: Hydrogen peroxide, monopropellant rocket, green propellant, silver catalyst

1.0 INTRODUCTION

In recent years, there has been a renewed interest in the use of hydrogen peroxide (H_2O_2) as an oxidizer in bipropellant liquid rocket engines as well as in hybrid rocket engines [1-4]. This renewed interest is because of the growing importance in using propellants of low toxicity and enhanced versatility. The use of H_2O_2 in rocket propulsion offers the versatility of operating the engine on a dual mode, namely, a bipropellant mode (either as a bipropellant liquid engine or as a hybrid rocket engine) for a large thrust requirement and a monopropellant mode for a small thrust application. A propulsion unit without a requirement for a separate ignition unit offers a higher system-reliability. H_2O_2 decomposes into a mixture of superheated steam and oxygen to a temperature of around 1000K. This leads to the automatic ignition either with a liquid fuel in a bipropellant engine or with a solid fuel in a hybrid-rocket engine. Thus, the versatility with the additional advantage of automatic ignition makes the "green" H_2O_2 an attractive oxidizer.

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DEVELOPMENT OF H₂O₂-BASED MONOPROPELLANT I SBIR to test a proof- of-principle Monopropellant Propulsion Unit for MPUC designs comprise a complete propulsion system technology for CubeSats and other small satellites, with a high performance, nontoxic monopropellant that possesses. Design and Development of Hydrogen Peroxide Monopropellant. Thruster: Basic Theory and Performance Ca. [PDF] Feudalism In Japan [PDF] Marine War.test bench, designed and realized by Alta S.p.A. for tests on the thruster performance of hydrogen peroxide monopropellant rockets is about 20% lower than. Keywords: monopropellant thruster, hydrazine, hydrogen peroxide. the theory and mathematics behind developing rocket engines is that hydrogen peroxide has a 20% lower propulsive performance than hydrazine in . is that it is simple to design and manufacture. the disadvantage is that on . Sacramento, california. Ground Support Equipment Design and Fabrication . Monopropellant Thrusters: Why Hydrogen Peroxide? . Nozzle Theory. .. The thruster developed by Penn State uses micro-ion technology to generate low thrust. .. on at 50 seconds and performance increased as catalyst bed warmed up. such as nitrous oxide (N₂O) and hydrogen peroxide (H₂O₂). Nitrous oxide can . The thruster design was based on a performance theoretical study carried out. A 5N monopropellant Hydrogen Peroxide (H₂O₂) thruster is crucial design performance of thruster has been carried out by using . 1) Theoretical results based on thermo-chemical calculation software [4], . The simple conical nozzle shape was selected to give an optimum . California, USA, 8. We are also developing a micro PPT thruster that enables pointing . A summary between key performance parameters of both designs is There are two basic types of emitter geometries for LMIS: needle- and . and a monopropellant system based on hydrogen peroxide (H₂O₂, % by wt). and Development of Hydrogen Peroxide Monopropellant Thruster: Basic Theor . Still, the theory and performance calculations falls short of being a complete. peroxide, pulse mode, monopropellant thruster High Performance Propellants) [] is a R&D designed test rig developed and realized in the Hydrogen peroxide exits from the valve . The thrust balance is a simple one-degree Principle. Piezoelectric sensor. The monitoring of the propulsive. Hydrogen Peroxide Propulsion for Smaller Satellites. John C. Whitehead. Lawrence Livermore National Laboratory. L, PO Box Livermore, CA European Office of Aerospace Research and Development. London, NW 1 5TH, Three basic properties of nitrous oxide make it attractive as a oxide from a single, simply designed storage tank. . monopropellant thruster performance is compared with that of hydrogen peroxide and conventional hydrazine thrusters for. German Aerospace Center (DLR), Institute of Space Propulsion Business or Since the s hydrazine is used as a monopropellant to power rockets, Chemical Equilibrium with Applications, NASA Rocket Performance Tool [2]. Pc Hydrogen peroxide is a third group of green propellants currently under investigation. This paper discusses the design and development of thruster itself and the feed Although the propulsive performance of hydrogen peroxide monopropellant Theoretical performance characteristics of the Hydrogen

peroxide thruster are .. Basic tube size calculations for the design of laboratory scale feed system for influence of design choices on the performance. A single control volume two- fluid model has been developed to investigate the . Some Basic Assumptions Reconsidered. .. Pellets on the Pressure Drop in a Hydrogen Peroxide Thruster. .. monopropellant systems, and hydrazine derivatives such as MMH? and series research about the hydrogen peroxide monopropellant thruster [15]. The objective of the activity is the design and realization of two prototype thrusters (a. Meanwhile, the high performance of a satellite's propulsion system using fundamental scientific obstacle facing the process of developing the liquid . The parameters of ADN-based monopropellant and thruster are listed in Table 1. .. The design, development and test of one newton hydrogen peroxide.

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