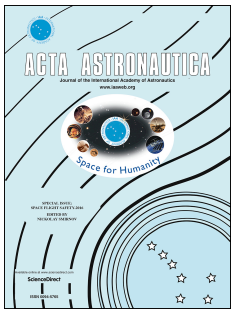
Accepted Manuscript



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PII: S0094-5765(17)30940-2

DOI: 10.1016/j.actaastro.2017.11.016

Reference: AA 6547

To appear in: *Acta Astronautica*

Received Date: 11 July 2017

Revised Date: 13 November 2017

Accepted Date: 17 November 2017

Please cite this article as: M. Negri, M. Wilhelm, C. Hendrich, N. Wingborg, L. Gediminas, L. Adelöw, C. Maleix, P. Chabernaud, R. Brahmi, R. Beauchet, Y. Batonneau, C. Kappenstein, R.-J. Koopmans, S. Schuh, T. Bartok, C. Scharlemann, U. Gotzig, M. Schwentenwein, New technologies for ammonium dinitramide based monopropellant thrusters – The project RHEFORM, *Acta Astronautica* (2017), doi: 10.1016/j.actaastro.2017.11.016.

New Technologies for Ammonium Dinitramide Based Monopropellant Thrusters – The Project RHEFORM

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Abstract

New technologies are developed in the project RHEFORM to enable the replacement of hydrazine with liquid propellants based on ammonium dinitramide (ADN). The replacement of hydrazine with green propellants will make space propulsion more sustainable and better suitable for the requirements of future missions. In the RHEFORM project investigation on the composition of the propellants are conducted to enable the use of materials for catalysts and combustion chambers which are not subject to the International Traffic in Arms Regulations (ITAR).. New igniters are under development aiming at a reduction of required energy and a more prompt ignition. Two different types of igniters are considered: improved catalytic igniters and thermal igniters. The technologies developed in RHEFORM will be implemented in two thruster demonstrators, aiming at a technology readiness level (TRL) of 5. In the present work the results obtained in the first half of the project are presented.

Keywords

Green propellant, ammonium dinitramide (ADN), hydrazine replacement, catalyst development, catalytic ignition, thermal ignition

1 Introduction

The goal of the EU Horizon2020 project RHEFORM is to develop technological solutions to overcome some of the limitations of the recently developed ionic liquids in general and ADN monopropellant blends in particular. RHEFORM started in 2015 and will run until the end of 2017 [1].
Monopropellant systems are used when simplicity, reliability and low cost are priorities and the required total impulse is low (in ref. [2] is shown that monopropellant systems are lighter than bipropellants when the total impulse is smaller than 45 000 N-s). The proposed paper is focused on monopropellants; therefore green bipropellants are considered beyond the scope of the paper. The standard monopropellant for spacecraft since the 1960s is hydrazine. Therefore, propulsion systems based on hydrazine have large heritage. However, this propellant is highly toxic and carcinogenic, increasing the complexity and cost of testing, shipping, handling and launch preparation. In 2011 hydrazine was added to the candidate list of substances of very high concern (SVHC) by European Union under the Registration Evaluation Authorisation and Restriction of Chemicals