SPACE PROPULSION SYMPOSIUM (C4)
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Author: Dr. Robert-Jan Koopmans
Austria

Mr. Sebastian Schuh
Austria
Dr. Yann Batonneau
France
Mr. Corentin Maleix
CNRS, France
Dr. Romain Beauchet
Université de Poitiers, France
Dr. Martin Schwentenwein
Austria
Mr. Manfred Spitzbart
Austria
Mr. Altan Alpay Altun
Austria
Dr. Carsten Scharlemann
University of Applied Science Wiener Neustadt, Austria

CATALYST DEVELOPMENT AND TESTING FOR ADN-FUEL BLENDS

Abstract

Monopropellant propulsion systems mostly rely on the rapid decomposition of a propellant on a catalyst. The net effect of the decomposition process is a significant rise in temperature of the products. Typical requirements for catalysts are that the decomposition reaction is fast, that they operate over extended periods of time and that the pressure drop over the catalyst is minimal. Over the past two decades, catalysts for HTP, ADN and HAN propellant blends, have received a lot of attention due to their characteristic as green propellant. A particular difficulty with ionic liquids is that a certain amount of preheating is required to initiate the decomposition process. This has system disadvantages such as necessary heating power and, in particular, the required time for pre-heating. The H2020 funded RHEFORM project aims at further developing the ADN technology in order to provide an alternative to hydrazine for a much wider field of space missions. One of the goals is to develop catalysts that allow a lower amount of preheating. To develop such a catalyst several aspects are investigated such as the choice of active phase, washcoat procedure, monolith material and form. The latter refers to the internal and external shape of the catalyst. Although catalyst beds of the particulate type are currently used in space, the focus is mainly on monolithic types. Significant advantages over beds of the particulate type are the lower pressure drop and no abrasion as the catalyst consists of one piece. With respect to monoliths, a particular interesting possibility is to use additive layer manufacturing techniques to print monoliths from ceramics; a technique that has recently become available. Contrary to manufacturing by extrusion, printing makes monoliths with complex 3D internal structures possible. Within the RHEFORM project the first steps are taken to further develop technology for 3D printed ceramic catalysts. This comprises, amongst others, selection of materials that can withstand the high temperatures expected in ADN-based

thrusters, selection of active phase, internal geometry of the catalysts etc. A dedicated demonstrator was designed and built to assess the effectiveness of the catalysts w.r.t. ignition of LMP-103S. This paper presents the results of these tests and discusses the way forward.