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DEVELOPMENT OF WATER PROPULSION SYSTEMS FOR SMALL-SCALE SATELLITES

Abstract

In recent years small scale satellites have seen a strong increase in numbers, but the life span of these satellites is limited due to the absence of an efficient propulsion system or even the absence of any propulsion system at all. Many existent and well establish systems use toxic and difficult to handle propellants, such as hydrazine, or inefficient systems such as cold gas propulsion. In order to extend the life span of these tiny satellites a water propulsion system is design. The electrolysis based propulsion system has a numerous advantages like easy handling, high storage density, low cost propellant with high trust levels and specific impulse which make this system a suitable candidate for small scale satellites propulsion. This paper presents an overview of the requirements and the research carried out on water propulsion systems. The design of the thruster is presented, manufacturing methods used as well as experimental installation and tests results. Also, the paper discuses the electrolysis system presenting the design and materials employed. The Romanian National Research and Development for Gas Turbine Institute Comoti has worked in recent years in the development of a 1N H2/O2 thruster for small scale satellites application, like CubeSats, gaining valuable knowledge in designing, manufacturing and testing of small thrust propulsion systems. The thruster was tested under atmospheric and vacuum conditions in pulse mode and steady state operations showing promising results. It delivers a specific impulse of approximately 380s (vacuum conditions) with an expansion rate of 12 and stoichiometric or near stoichiometric burning conditions. The thruster is design to work with an electrolysis system. A small scale single cell experimental system with a 49 cm2 polymeric membrane was designed and tested.