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THERMALLY DECOMPOSED HYDROGEN PEROXIDE FOR SMALL SCALE MONOPROPELLANT PROPULSION APPLICATION

Abstract

This paper reports on the feasibility and performance of the thermal decomposition of hydrogen peroxide for space propulsion applications. Downsized propulsion systems are prerequisites for the normal operation of miniaturised satellites such as CubeSat and PocketQube with versatile missions. With regard to micro chemical propulsion, one of the long lasting issues is excessive heat loss due to the large surface to volume ratio as its scale goes down. In order to overcome the large heat loss in downsized propulsion and corresponding degraded propulsion efficiency, this study focuses on the decomposition behaviour of the propellant: its decomposability both thermally and catalytically. We designed a monopropellant thruster with an intended thrust of 1 N, facilitating the decomposition of propellant via thermal load and catalyst active material. An experiment based study was conducted with varying thermal conductivities within the decomposition reaction chamber and also with catalyst active materials, with structural/catalytic materials either increasing thermal conductivity or chemical reaction surface of the catalyst within the chamber. The results showed that in a fixed thermal load condition, there was an increase in thrust with an increasing amount of catalytic materials, against conductive materials, up to a certain point. However, it also reports a converging status as after a certain point it gives diminishing returns in terms of thrust. Further study is being conducted and will be presented regarding the optimization of catalyst/conducting materials in the catalyst bed, additionally determining how much of thermal load can replace catalyst and what is desirable reactor structures efficiently triggering thermal decomposition of propellant.