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FEASIBILITY OF A DUAL-PLATE INJECTOR FOR THROTTLING OF MONOPROPELLANT THRUSTER

Abstract

The purpose of this research was to suggest a compact size of throttleable injector that is able to be equipped with monopropellant thruster in the range of five different level. The throttleable injector consisted of two plates; radial slotted and showerhead type plate. The radial slotted type plate was located in front of the showerhead type plate and adjusted the number of orifices on the showerhead type plate by rotating for controlling the mass flow rate and injector pressure at the same time. To verify performance of the injector, hot-fire tests were conducted by mounting on 50 N monopropellant thruster using 90wt.% hydrogen peroxide. In sum of the result, it proved that the thrust changed by the dual-plate injector. However, there was difference between the theoretical and the experimental thrust about 19.45 % to 38.11 %. The reason of gap conjectured by two assumptions; amount of mass flow rate and decomposition of catalyst bed. According the calculated mass flow rate, it can be known that propellant injected more than theoretical values; therefore, the chamber pressure had to be higher as much as it did. From this inference, the reason of difference seemed to be not fully decomposed due to lack of volume of catalyst bed. The temperature of catalyst bed had to be reached the temperature of 1020 K where the temperature of adiabatic decomposition of 90wt.% hydrogen peroxide used in the experiment, but it was reached about 900 K according the measured temperature at duration of the decomposition on catalyst bed during the experiment. This study was to verify the feasibility of the dual-plate throttleable injector in the range of throttling. We obtained probability of the changes in mass flow rate and chamber pressure through four times of experiment, so it is proved that the dual-plate injector could throttle. However, the desired thrusts were not gotten since hydrogen peroxide was not fully decomposed due to lack of catalyst bed volume, it remained to be improved on. As a future plan, the catalyst bed will be modified for more accurate and the desired thrust.