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MEASUREMENT OF SOLID FUEL PORT PRESSURE BY USING EXPOSED HDPE HYDROGEN
PEROXIDE CATALYTIC DECOMPOSITION HYBRID THRUSTER**Abstract**

In this research, solid fuel port pressure was measured by using exposed HDPE (High Density PolyEthylene) hydrogen peroxide catalytic decomposition hybrid thruster. Hybrid thruster with bipropellant that classically consists of solid fuel and liquid oxidizer has advantages of solid propellant and liquid propellant simultaneously. Because fuel grain configuration changes according to regression rate and time, it is difficult to analyze solid fuel theoretically by CFD (Computational Fluid Dynamics), so it is essential to do it experimentally. Studies on hybrid thruster generally measured properties such as thrust, solid fuel mass, and pressure and temperature of catalyst bed, pre-combustion chamber, and post-combustion chamber. However, those measured solid fuel port pressure are scarce. Gap between solid fuel and case, which allows the former to be inserted smoothly into the latter, is hard to be sealed because of hole for pressure sensor. Therefore, exposed HDPE hydrogen peroxide catalytic decomposition hybrid thruster invented to test various solid fuel length was utilized to install pressure sensor without case. HDPE, hydrogen peroxide, and 10-16 mesh MnO₂/Al₂O₃ were selected as fuel, oxidizer, and catalyst for decomposition of hydrogen peroxide. Specifications of thruster were established as oxidizer to fuel mass ratio of 6.5, combustion chamber pressure of 20 bar, specific impulse of 2349.7 m/s, characteristic velocity of 1653.9 m/s, nozzle expansion ratio of 3.8267, thrust of 250 N, fuel mass flow rate of 14.1862 g/s, oxidizer mass flow rate of 92.2104 g/s, injector orifice discharge coefficient of 0.7, injector orifice quantity of 33, injector orifice diameter of 391 μ m, characteristic velocity efficiency of 0.95, nozzle throat diameter of 10.3 mm, nozzle exit diameter of 20.2 mm, catalyst bed decomposition capacity of 1.96 g/s/cm³, catalyst bed diameter of 45.8 mm, catalyst bed length of 33.0 mm, fuel port diameter of 14.6 mm, fuel port length of 250 mm, nozzle convergent half angle of 45 deg, and nozzle divergent half angle of 15 deg by using NASA CEA (Chemical Equilibrium with Applications). By leak test, seal between HDPE and pressure sensor was confirmed before combustion test. By combustion test, solid fuel port pressures were measured at points of 50 mm, 100 mm, 150 mm, and 200 mm from the front of HDPE. Moreover, post-combustion chamber pressure was also measured to compare with that measured by using unprocessed HDPE.