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PERFORMANCE TESTING OF SMALL SCALE RESISTOJET THRUSTER WITH 3D PRINTED HEAT EXCHANGER

Abstract

A green propellant resistojet was designed, manufactured, and experimentally tested targeting thrust generation in the range of several hundred micro newtons. A novel type of 3D printed heat exchanger was developed and integrated into the chamber. Either water or hydrogen peroxide was used as green propellant for the thruster. The heat exchanger facilitated the evaporation of water and the thermal decomposition of hydrogen peroxide. A resistive heating element was positioned at the core of the cylindrical thruster, supplying the necessary thermal energy to the heat exchanger. During experimental tests, complete evaporation of water and thermal decomposition of hydrogen peroxide were achieved, demonstrating that the 3D printed heat exchanger provided sufficient heat exchange performance while offering design flexibility in shape for the micro fluid within the chamber. Comparative analysis of thruster performance data was conducted between water and hydrogen peroxide as propellants, highlighting additional energy conversion through thermal decomposition in the case of hydrogen peroxide. Detailed performance results will be reported, including suggestions for heat exchanger design parameters using 3D printers and insights into the thermal decomposition effect of hydrogen peroxide without a catalyst.