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SPACE PROPULSION SYMPOSIUM (C4)
Hypersonic and Combined Cycle Propulsion (5)

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EXPERIMENTAL AND NUMERICAL INVESTIGATION OF PRIMARY ROCKET-ASSISTED COMBUSTION UNDER RAMJET-MODE CONDITION IN ROCKET BASED COMBINED CYCLE (RBCC) ENGINE

Abstract

The experimental and numerical studies have been performed to investigate liquid kerosene (JP-10) combustion in RBCC combustor under typical ramjet-mode condition. Due to the low total temperature of incoming airflow at the low Mach number region of ramjet mode, the relative low flow-rate primary rocket was employed to assist the ignition and combustion of liquid kerosene (JP-10) with supersonic airflow at Mach number 1.5 and stagnation conditions of 0.6 MPa and 620 K in RBCC combustor. The secondary fuel (JP-10) has been injected into airflow by two strut injectors located behind the primary rocket and a downstream flush-wall injector. The strut injectors make the fuel easily be distributed into main airflow and the results indicate the injected fuel can accomplish steady and efficient combustion due to assistant effect of the rocket plume. To improve the performance of RBCC combustor, the influences of cavity and wall injection position have been investigated. The comparison of the wall pressure distributions shows the cavity plays an important role in the combustion of wall injection fuel, the obvious pressure rise (about 11% for the maximum pressure in the combustor) has been found when wall injection associated with cavity was adopted. Moreover, the wall injection location and the distance between the wall injection and cavity need to be further considered to obtain optimal engine performance.