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EXPERIMENTAL STUDY ON OXYGENATION CONSTANT VOLUME COMBUSTION
CHARACTERISTICS OF HYDROGEN INTERNAL COMBUSTION ENGINE

Abstract

With the advantages of high specific impulse and pollution-free, LO₂/LH₂ is the preferred propellant for large-scale mobile and long-term orbital space transportation system, but cryogenic LH₂ has high evaporation rate, evaporated gases are difficult to use, resulting in a decrease in the utilization efficiency of propellant, it is urgent to carry out research on cryogenic propellant integrated vehicle fluids (IVF) technology, IVF can integrate functions of tank pressurization, attitude control and power generation into one compact system, and realize the energy integration design to achieve the optimal system. The power generation based on hydrogen and oxygen internal combustion engine(H₂/O₂ ICE) has high energy conversion efficiency and high thermal quality, which is suitable for energy integration and utilization, and H₂/O₂ ICE adapted to the space environment has become the first key technology of IVF system. Due to the limitation of the limited propellant carried by spacecraft, the H₂/O₂ ICE for aerospace is suitable for pure hydrogen, pure oxygen and hydrogen-rich combustion. In order to realize the high-performance and reliable engines, it is particularly important to study the combustion characteristics of H₂/O₂ ICEs, and the technical route of hydrogen ICE constant volume combustion gradually increases oxygen is adopted to explore the combustion characteristics of hydrogen ICE under the condition of oxygen enhancement and even pure oxygen . The experimental contents include: the H₂/O₂ flame propagation process and laminar flow combustion area delineation in the constant volume combustion bomb; the flame propagation process and combustion characteristics of H₂/O₂ mixture under different equivalent ratios ; the premixed laminar flow combustion characteristics of H₂/O₂ mixture under different O₂ concentrations; combustion characteristics of premixed laminar flow of H₂/O₂ mixture under different temperature and pressure initial conditions. With the increase of the equivalent ratio, the combustion velocity gradually increases. and with the increase of O₂ concentration, the laminar combustion velocity of the equivalent ratio to the H₂/O₂ flame will increase linearly and multiply, but the amplitude of the change will gradually decrease with the increase of the equivalent ratio. Under the condition of high O₂ concentration ,the combustion rate of laminar flow is maintained at a very high level, and the change with equivalent ratio is small.