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RESEARCH ON THE SUPPRESSION METHODS OF HIGH FREQUENCY PRESSURE PULSATION IN COMBUSTION CHAMBER FOR LIQUID ROCKET ENGINE

Abstract

Abstract: High chamber pressure and large thrust are important development directions for the performance improvement of the liquid oxygen kerosene staged engines in recent years, and the diameter of the combustion chamber also gradually increased. Combustion chambers with a diameter of less than 200mm have a strong adaptability to high-frequency pressure pulsation, acoustic cavities can be used to achieve stable combustion. When the combustion chamber's diameter more than 200mm and less than 400mm, possibility of combustion instability turns greater and injection surface baffles are added to successfully suppress the high-frequency pressure pulsation. However, when the diameter of the combustion chamber exceeds 400mm, the "large diameter" characteristic of combustion chamber is particularly prominent. The potential risk of high-frequency combustion instability caused by high energy density and large structural scale is significantly increased, and the requirements for pressure pulsation suppression measures are also more stringent. This paper investigates the high-frequency combustion instability of F-1, RD-170 and China's liquid oxygen kerosene engines, summarizes the structural characteristics, inhibition mechanism and research status of flow distribution plate, acoustic cavities, gas-liquid injectors and anti-pulsation baffles. The analysis results show that gas generator circulating engines mostly use acoustic cavities and regenerative cooling baffles to suppress the pressure pulsation of the combustion chamber. As the diameter of the combustion chamber increases, the number of acoustic cavities and baffles also increases. Liquid oxygen kerosene staged engines mostly adopt flow distribution plate, acoustic cavities, gas-liquid injectors and injector baffles to improve the stability margin of the combustion chamber. Especially when the diameter of the combustion chamber more than 400mm, matching of structural parameters between different suppression measures will be crucial.