

IAF SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM (IP)

Author: Dr. chen cao

Xian Aerospace Propulsion Institute, China, 18681840502@163.com

Mr. Yang Yongqiang

Xi'an Aerospace Propulsion Institute, China, hoyeydew@sina.com

Prof. Yonghua Tan

Academy of Aerospace Propulsion Technology, China Aerospace Science and Technology Corporation
(CASC), China, aoapt_casc@163.com

Prof. Chen Jianhua

Xi'an Aerospace Propulsion Institute, China, chenjianhua_0611@163.com

Dr. Yunhao Liu

Xi'an Aerospace Propulsion Institute, China, 18681840502@163.com

RESEARCH ON THE ACOUSTIC CHARACTERISTICS OF FLOW DISTRIBUTION PLATE IN
LOX/KEROSENE STAGED COMBUSTION ROCKET ENGINE**Abstract**

The current LOX kerosene staged combustion rocket engines all use the oxygen-enriched gas generator cycle. The flow process of the high-temperature oxygen-enriched gas generated by the generator in the gas conduit is very complicated, which makes the velocity and pressure extremely uneven in front of the injectors, reduces engine performance and even stimulate the combustion instability. In order to solve this problem, the engine is equipped with a flow distribution plate at an appropriate position upstream of the injectors. The main functions of the flow distribution plate are reflected in the following two aspects: (1) When the flow passes through the plate, the large vortex is broken into small vortices, so that the pressure and velocity of the flow field become more uniform in front of the injectors; (2) It provides an acoustic damping effect on the pressure pulsation generated in the combustion chamber, which is benefited to improve the combustion stability margin. In this paper, the acoustic frequency domain finite element simulation method is used to study the influence of the structural parameters of flow distribution plate on its acoustic characteristics. The difference in acoustic characteristics before and after install the flow distribution plate was compared, the influence of the thickness and aperture diameter of the plate on the acoustic characteristics is analyzed. The research results show that: (1) The acoustic dissipation of the plate exhibits a strong frequency dependence. Below 1500Hz, the plate does not change the acoustic dissipation effect of the original structure; in the frequency range of 1500Hz-1900Hz and 3650Hz-4000Hz, the existence of the plate weakens the original dissipation of the structure; the plate significantly enhances the acoustic dissipation effect in the frequency range of 1950Hz-2900Hz and 3100Hz-3600Hz, the transmission loss increases by about 1.5dB, and the acoustic energy dissipation increases by about 40%. (2) Below 4000Hz, the thickness of plate has very small influence on the acoustic characteristics, or even negligible. (3) Within 1900Hz, the aperture diameter of the plate has little effect on acoustic characteristics; within 1900Hz-4000Hz, the reduction of the aperture diameter will significantly improve the acoustic dissipation. When the diameter is reduced from 10mm to 6mm, the transmission loss increases by about 2dB; the transmission loss of the flow distribution plate increases abruptly at 1950Hz, 3000Hz and 3550Hz, and the acoustic dissipation is significantly enhanced.

Key words: LOX/kerosene staged combustion engine; Flow distribution plate; Acoustic characteristics; Transmission loss