UDC 629

INVESTIGATION ON CONCEPT AND PRINCIPLE OF SOLID-FUEL ROCKET SCRAMJET

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Under the traction of hypersonic flight technology, a new scramjet configuration using solid fuel as propellant was proposed in this paper, namely, the solid-fuel rocket scramjet. For the solid-fuel rocket scramjet, the integrated flow channel design method was established from the four modules of atmospheric model, intake, combustor and nozzle. The principle experimental study was carried out for the configuration scheme designed. The numerical model and calculation method suitable for the solid-fuel rocket scramjet were established, and the applicability was verified by the experimental results. Based on the numerical method established, the applicability of the integrated flow channel design method established was verified. The results show that the integrated flow channel design method established in this paper has certain applicability, which has certain guiding significance for the preliminary design of solid-fuel rocket scramjet. The evaluation methods of mixing characteristics based on the gas mixing degree and oxygen-fuel ratio were established. The effects of sweep angle and height changes of the staggered plate structure introduced in the experimental study on the mixing and heat release characteristics in the combustor were quantitatively analyzed. The results show that, in the design process of staggered plate structure, the sweep angle should be based on the width of the plate and the length of the straight section of plate. The engine performance increases with the sweep angle reducing. The better value of the height is around 14mm.

Results are shown in the following figures.

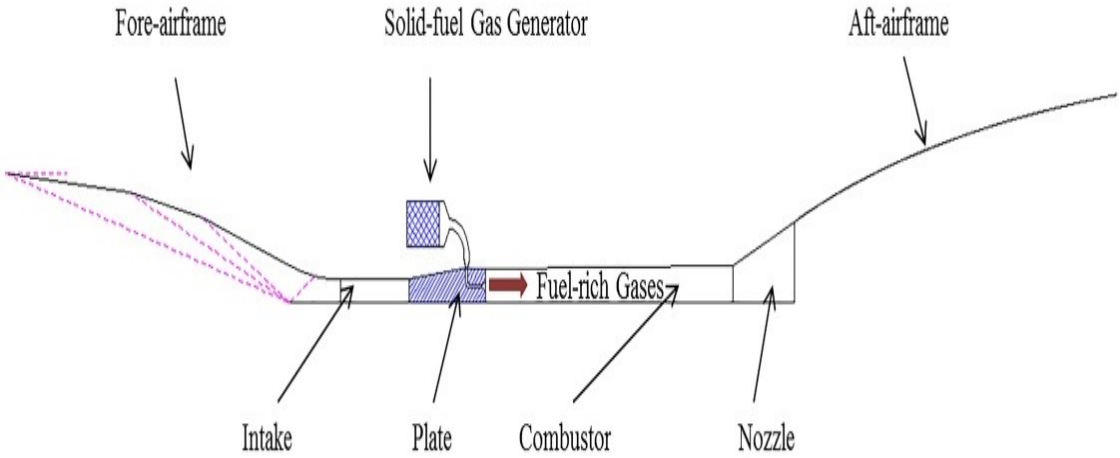

Fig. 1. Scheme of solid-fuel rocket scramjet

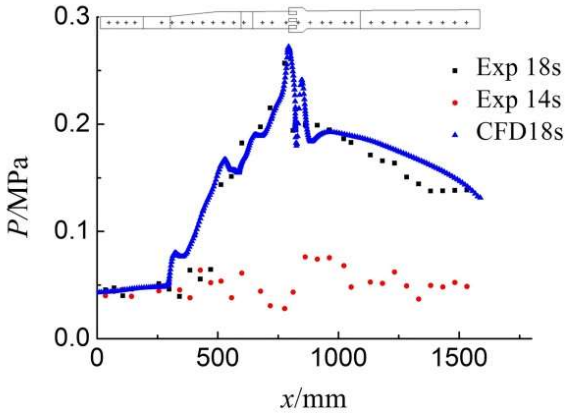

Fig. 2. The pressure distribution along the wall surface

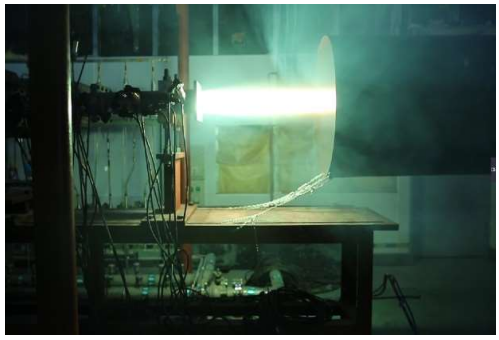

Fig. 3. The engine hot test

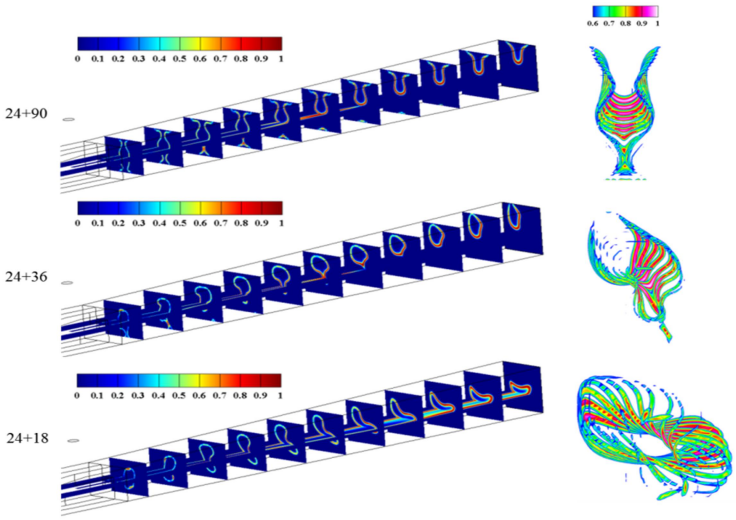

Fig. 4. The gas mixing degree of combustor at different sweep angles (Height + sweep angle)

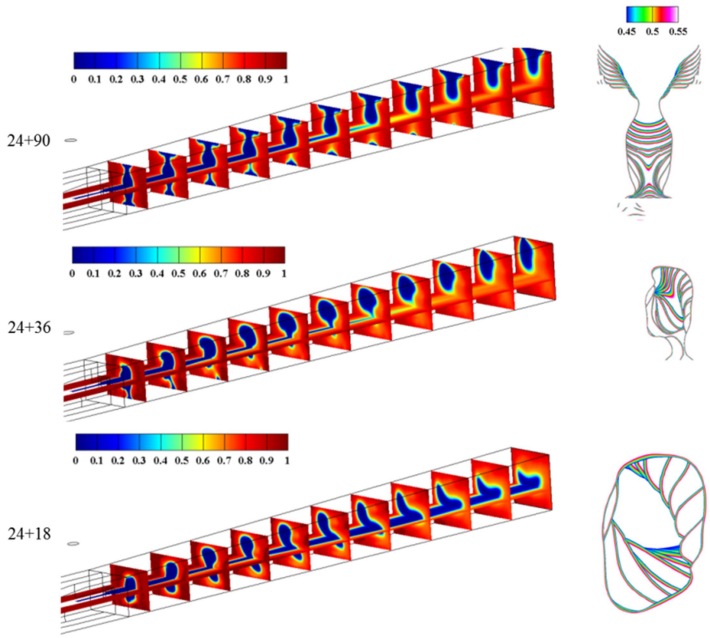

Fig. 5. Oxygen-fuel ratio of combustor at different sweep angles (Height + sweep angle)

References

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2. Lv Z., Xia Z., Liu B., et al. Experimental and Numerical Investigation of a Solid-Fuel Rocket Scramjet Combustor. Journal of Propulsion and Power, 32(2), 1-6, 2015.