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NUMERICAL SIMULATION OF INFLUENCE OF INJECTOR PARAMETERS ON COMBUSTION IN LOX/METHANE ENGINE

Abstract

Methane as a good propellant has some characteristics such as less carbon deposition, good cooling performance, noncoking, low cost, and it can be obtained widely, also can be obtained from the Martian atmosphere. Therefore, LOX/methane engine is preferably suitable for reusable and long-term on orbit spacecraft.In this paper, the LOX/methane sub-scale thrust chamber three dimensional numerical simulations are investigated by using the finite element method bases on the oxygen/methane 13 components 18 steps reaction mechanism combustion model, to analyze the influence of injector types, LOX injector post thickness, injector density, methane injection temperature on combustion efficiency, the heat flow of chamber and combustion stability.The numerical results show that reducing methane injection temperature, using more injectors and the swirl coaxial injector replacing shear coaxial injector can improve the combustion efficiency; increasing the LOX injector post thickness, reducing methane injection temperature can reduce the heat flow of chamber; based on the PISO algorithm, the combustion stability of the thrust chamber is studied. It is found that the low frequency combustion instability can be suppressed when the length of the combustion chamber meets the requirement of the propellant flow rate.This study has important engineering application value for LOX/methane rocket engine development.

Keywords: LOX/methane engine, numerical simulations, injector types, injector density, combustion stability.