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EXPERIMENTAL RESEARCH FOR THE EFFECTS OF TRAILING EDGE STRUCTURE ON THE SUPERSONIC MIXING LAYER

Abstract

A turbulent supersonic mixing layer plays a very important role on combustion performance of a dual-combustor ramjet (DCR). Based on the study of fuel-rich gas and supersonic inlets inside DCR, the physical model of supersonic turbulent mixing layer is built to simulate specific engineering problems in this paper. Passive mixing enhancement mechanism with different trailing edge structures is studied by using the technique of Nanoparticle-based Planar Laser Scattering (NPLS) and Particle Image Velocimetry (PIV). Trailing edge test pieces are designed for research of the passive enhancement technique. These pieces have a thickness of 1mm, and the shape of sawtooth with different space width. Accurate flow structures are gotten and the evolution of space and time of mixing layer is studied in this paper. Referring to the space development, different flow field structures of serrated trailing edge are successfully observed. Firstly, the laminar region length on the tip of the serrated trailing edge is shorter than that at the trough of the serrated trailing edge. Secondly, the transition region length on the tip of the serrated trailing edge is longer than that at the trough of the serrated trailing edge. On the other hand, in terms of time development, the speed of large scale structure in the flow field of mixture layer is calculated by use of cross-correlation techniques, the whole large scale structure shows the flow characteristics of fast motion and slow change. The research results can provide reference for developing mixing enhancement techniques of supersonic mixing layer.