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EXPERIMENTAL STUDY ON THE CHARACTERISTICS OF SUPERSONIC FLOW SEPARATION AND REATTACHMENT OVER BACKWARD FACING STEP DISTURBED BY LASER INDUCED PLASMA

Abstract

In order to achieve success in the supersonic flow ignition and stable combustion, concave cavity flame holder has been widely applied to various kinds of supersonic combustion chamber, in which the backward facing step (BFS) is an important part. The recirculation flow zone downstream of the BFS is used for fuel injection at low speed and stability of flame. The configuration under the condition of supersonic flow involve some important physical phenomenon such as complex separation, reattachment and shear layer. In this paper, according to the theory of scramjet combustor concave cavity structure, the experimental study on the characteristics of separation and reattachment of supersonic flow over BFS under Mach 2 will be carried out in the low noise wind tunnel. Based on the fine flow structures visualized via the pulse laser schlieren, the coherent structure formation and evolution in the separated shear layer will be revealed. The shear layer instability and the reattachment oscillation will be investigated based on the data acquired using high-frequency pressure acquisition system. The plasma excitation induced by nanosecond pulse laser will be used to explore the control effect of plasma on the BFS flow separation shear layer under different conditions, and the plasma disturbance law of the separation shear layer will be preliminarily obtained.