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RESEARCH ON BOUNDARY LAYER COMBUSTION FOR SKIN-FRICTION REDUCTION

Abstract

One demonstrated method for reducing skin-friction drag on a surface exposed to supersonic flow is the injection and combustion of hydrogen fuel in the boundary layer. In order to study the performance and effects of combustion in compressible boundary layer for skin-friction reduction. By using the Transition k-kl-omega model to simulate the diffusion and reaction cases of the 2D parallel injection of Burrows and Kurkov's hydrogen parallel flow, it is found that the results that are obtained by using the Transition SST model are good agreement of exit parameter profiles with experimental data were firstly, and the applicability of was verified. Then applications of the combustion on boundary layer of the two-dimensional numerical simulation about the turbulence model was conducted. Hydrogen fuel is applied to the combustion chamber model of the scramjet engine by changing the operating conditions (Tair/Tfuel, mole fraction of h2o and Pair/Pfuel). The variation of skin-friction coefficient and heat flux along the wall of the flow channel is analyzed. The results show that when the changed cases are increased on the basic working conditions, the self-ignition point of the flame is advanced, indicating that it is beneficial to the lateral diffusion of hydrogen and the mixing and combustion of hydrogen and air in a short time, so as to achieve better skin-friction reduction.