THE EFFECT OF TURBULENCE OF FLOW DEVELOPMENT IN SCAMJET COMBUSTOR

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Abstract: A two-dimensional numerical simulation of flow in the scramjet combustor of TsAGI with due regard for turbulence–chemistry interaction has been performed. It is shown that the inclusion of the turbulence–chemistry interaction model into the simulation leads to a change in the dynamics of processes in the combustor channel with fuel supply pylons and a backfacing step for combustion stabilization. After ignition of the fuel–air mixture triggered by flow throttling at the end of the combustor, the arising combustion zone reaches the backfacing step and the pylons much faster than in the calculations without regard for turbulence–chemistry interaction. The reasons for such a change in the dynamics of processes have been studied. It was found that the intensity of temperature fluctuations in the preflame zone with large velocity gradients may reach 6%–7% (100–120 K) due to turbulence generation in this zone. Such temperature fluctuations have a significant impact on the mean reaction rates of fuel oxidation, thus leading to the acceleration of processes.

Keywords: scramjet combustor; combustion; turbulent temperature fluctuations; turbulence–chemistry interaction; numerical simulation

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