Numerical simulation of hydrogen combustion in variable cross-section channel of at different wall temperatures

Kruchkov S V[@] and Arefyev K Yu

Central Institute of Aviation Motors, Aviamotornaya Street 2, Moscow 111116, Russia

[@] kruchkov-93@mail.ru

The paper is devoted to numerical simulation of hydrogen combustion in a supersonic flow in a channel of variable cross-section. According to preliminary studies, it has been established that the ignition induction period, and the completeness of hydrogen combustion depend on flow path wall temperature (Tw) of the [1]. To study the effect of the wall temperature on the parameters of the working process, numerical simulation of hydrogen combustion in a model channel of variable cross-section based on the solution of the complete system of Navier-Stokes equations using the semiempirical RANS model of turbulence k-ω SST and the mechanism of chemical kinetics V.I. Dimitrov [2]. The simulation was carried out in an axisymmetric formulation. Static pressure and temperature, absolute value and direction of the air flow velocity vector were set at the entrance to the channel. Hydrogen was supplied through two feed belts. The oxidizer excess coefficient in the flow path corresponded to stoichiometric, while through the first supply belt the hydrogen consumption was 60% of the total flow, and through the second– 40%. Calculations were carried out for various values of Tw and for the case of an adiabatic wall. It was found that with an adiabatic wall, the combustion completeness coefficient is 15% higher than for the case when the wall temperature is 500 K, while the augmentation in the flow momentum increases by 25%. Acknowledgments: The reported study was funded by RFBR, project number 20-38-90077.

[1] Bao W, Zong Y, Chang J, Yang Q and Hu J 2011 *Proceedings of ISAIF10*
[2] Dimitrov V I 1977 *React. Kinetic Catal. Lett.* **7** 81–86