DIRECT NUMERICAL SIMULATION OF TURBULENT COMBUSTION OF GASES IN TWO-DIMENSIONAL APPROXIMATION

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Abstract: The technique for Direct Numerical Simulation (DNS) of two-dimensional (2D) turbulent flame propagation in gaseous reacting mixtures in a stationary, homogeneous, and isotropic turbulence has been proposed. The technique is based on the detailed kinetic mechanism of combustion of a multicomponent reacting mixture and does not contain any empirical fitting parameters. The technique was applied to the calculation of turbulent combustion of hydrogen–air mixture. Comparison of the calculation results with experimental data showed that there exists qualitative agreement between them: in both calculations and experiments, the turbulent burning velocity increases with the turbulence intensity and the three-dimensional turbulence in the experiment increases the intensity of exchange processes and the surface area of the flame and, hence, its propagation velocity more than 2D turbulence. Furthermore, the concentration of active reaction centers — hydroxyl OH and H and O atoms — in a turbulent flame is less than in its laminar analog, which also agrees with experiments.

Keywords: direct numerical simulation; turbulent combustion; hydrogen

Acknowledgments

The work was supported by the Russian Foundation for Basic Research (project ofi-m No. 16-29-01065).

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Received January 18, 2017

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