NUMERICAL SIMULATION OF COMBUSTION PROCESSES FOR HYDROGEN-AIR MIXTURE IN A VARIABLE CROSS-SECTION PIPE

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Abstract

We used mathematical models of different orders to investigate various mechanisms of hydrogen oxidation kinetics. We considered the models of a closed adiabatic reactor, and one- and two-dimensional flow reactors. We accordingly selected chemical kinetic mechanisms from the list of those integrated in our hydrocode. We simulated flow and combustion processes in a variable cross-section pipe. We studied the effect the geometric parameters of the flow duct have on the gas dynamics inside it. We used thermodynamic equilibrium methods to compute a one-dimensional flow in the pipe. The results show that various mechanisms of chemical kinetics affect the integral characteristics of the flow and heat transfer in a variable cross-section pipe. We detect certain features of gas dynamics that affect combustion and ignition processes. A comparison to the one-dimensional technique shows a satisfactory agreement of the integral parameters.

Keywords

Combustion, hydrogen-air mixture, gas dynamic computation, simulation of combustion in a pipe, reactor-based approach

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