Experimental-numerical investigation of hydrogen-methane combustion in model power plant combustion chamber

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Recently hydrogen and methane-hydrogen mixtures combustion technologies are finding larger application in the design and retrofitting of gas turbine power plants with lean premixed combustion. At the same time, the issue of the combustion processes of hydrocarbon fuels with hydrogen additives simulation is of great relevance. One of the problems of the methane-hydrogen fuel combustion simulation is the choice and verification of the kinetic combustion mechanism, as well as the combustion processes results validation with experimental data. Therefore, the purpose of this paper is to verify the proposed combustion model with the chosen kinetic combustion mechanism.

In the work, a computational and experimental determination of the combustion products concentrations and the pollutant emission during methane-hydrogen mixture combustion under various operating conditions was carried out. A model power plant combustion chamber with the setup of a premixed air-fuel combustion was chosen as the object of research.

As a result of the computational and experimental research, it was found that the implemented mathematical combustion model for methane-hydrogen mixtures shows good qualitative and quantitative agreement between the calculated and experimental data on the main combustion products, as well as a qualitative agreement between the data on the pollutant emissions. In the following, this combustion model in conjunction with the selected kinetic combustion mechanism can be used to analyze the emission characteristics of the developed power plant combustion chambers designed to operate on hydrogen-containing mixtures.