Control of the combustion limits of methane-air flames by modifying mixtures with hydrogen

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Currently, the use of an environmentally friendly fuel - methane - is being intensively introduced into technological installations and vehicle engines. This is due to its high mass heat of combustion, industrial availability and moderate cost. However, the methane-air fuel mixture is characterized by a relatively narrow range of combustion modes and reduced flame stability. To overcome these shortcomings, it is possible to add a small amount of hydrogen to the fuel mixture. Due to the short ignition delay and high combustion rate, hydrogen provides increased combustion stability. The work is devoted to the experimental study of the stability characteristics of a pre-mixed methane-air flame with the addition of hydrogen.

The ranges of expansion of the rates of stable combustion of a pre-mixed methane-air flame with different percentages of hydrogen addition under normal and reverse gravity conditions were determined experimentally. The existence of a lean methane-hydrogen-air flame under reverse gravity in contrast to normal gravity conditions was observed. The effect of adding hydrogen on the flame dynamics and shape under normal and reverse gravity conditions was investigated. The influence of hydrogen in ensuring stable combustion of a lean flame under reverse gravity has been shown to be greater than under normal gravity.

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