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COMPUTER SIMULATION OF THE THERMAL STATE OF THE COMBUSTION ZONE OF MICROJET BURNERS WITH THREE-ROW FUEL SUPPLY

Summary. *The results of CFD simulation of the thermal state of the combustion zone in microjet burners with a three-row fuel supply at a constant heat output are presented. The influence of serial number of the row of fuel supply system on the thermal state of the active combustion zone in the burners is established.*

Key words: *microjet burners, three-row fuel supply, a series of gas supply holes, combustion zone temperature fields, temperature pulsation fields.*

The reliability and durability of stabilizer-type burner devices is largely determined by the thermal state of their components [1-7]. The thermal state of the device's combustion zone is determined by the temperature values in this zone and its pulsation levels.

This work is devoted to the study of temperature regimes of the combustion zone of microjet burners with three-row fuel supply. Computer modeling of the thermal state of the zone was conducted to determine the effects of burner design parameters on the temperature regime of the active combustion zone. The research method is consistent with modern international practice of mathematical modeling [9–14].

A schematic of the stabilizer-type burner module under study is presented in [8]. The three-row fuel supply system consists of three sections of gas supply holes, located at a specified distance from the tear edge of the stabilizer. Natural gas was used as the fuel, and air as the oxidizer. The study analyzed the thermal state of the burner's combustion zone with fuel supplied from different rows of gas supply holes.

Figures 1-2 show typical results of computer modeling of the thermal state of the combustion zone in burners for a constant equipment heat output. Figure 1 illustrates the temperature fields for fuel supply from different rows of gas supply holes.

As can be seen from the data provided, the temperature levels in the channel increase with the lower the number of the corresponding row of gas supply holes. However, supplying fuel gas to all three rows leads to an increase in the downstream temperature in the channel in the recirculation zone. Regarding the recirculation zone itself, relatively high temperatures occur for the first and second rows of gas supply holes. However, when fuel is supplied to the third section, the temperature in this zone is decreasing significantly.

The obtained research data indicate that the combustion zone thermal characteristics for the first and second row of fuel supply situations are similar qualitatively and quantitatively. However, the temperature regime of the active combustion zone for fuel supply from the third row has certain peculiarities.

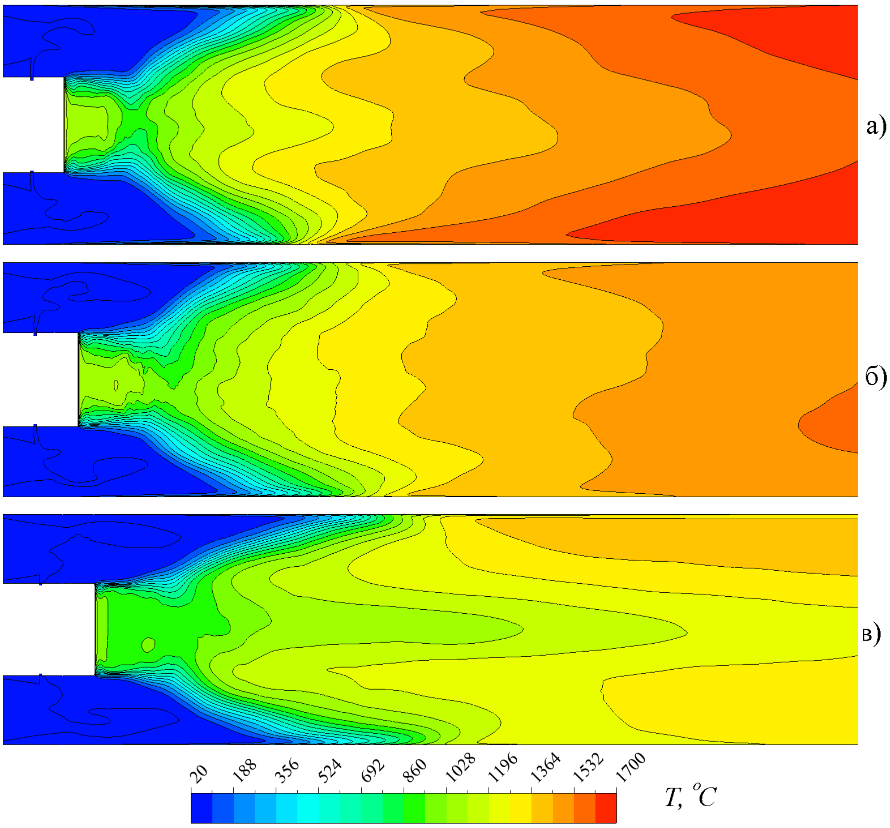

Fig. 1. Temperature field *T* in the longitudinal section of the flame stabilizer passing through the axis of the gas supply holes, when fuel is supplied to the first (a), second (b) and third (c) sections

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Regarding the temperature fluctuation fields in the combustion zone of the burner devices studied, the following patterns were observed. Fuel supply conditions in different rows of gas supply holes have a significant impact on the temperature fluctuation levels in the active combustion zone (Fig. 2).

As can be seen from the obtained data, the highest temperature fluctuations are generally observed when fuel is supplied to the first section, lower ones to the second section, and the lowest ones to the third section. In the recirculation zone behind the stabilizer, temperature fluctuations are relatively low. It should be noted that they are significantly lower when fuel gas is supplied to the third row of gas supply holes.

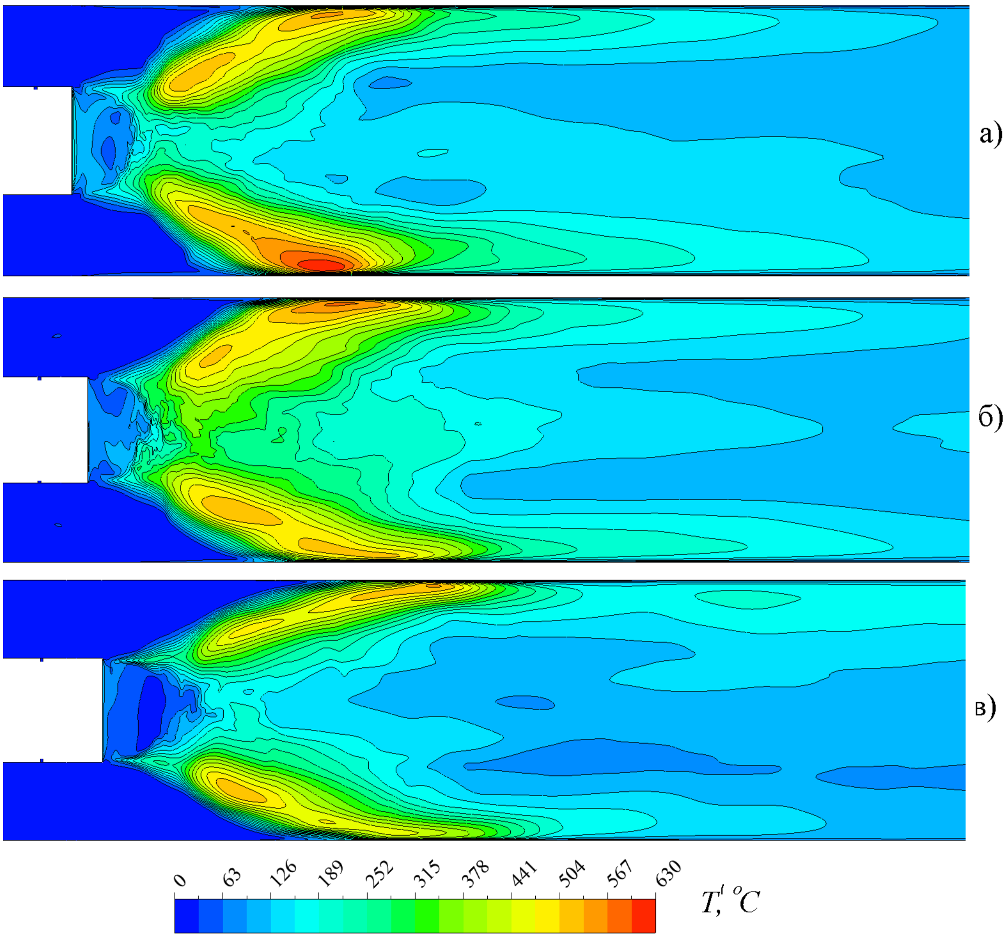

Fig. 2. Field of temperature pulsations in the longitudinal section of the flame stabilizer passing through the axis of the gas supply holes, when fuel is supplied to the first (a), second (b) and third (c) sections

It is noteworthy that, beyond the recirculation zone, in the subregions corresponding to the inter-stabilizer channels, there are zones with the highest temperature fluctuation levels. However, slightly lower temperature fluctuations in these zones occur when fuel is supplied to the third row of gas supply holes.

Studies of microjet burners with three-row fuel supply have revealed patterns in the influence of the serial number of row fuel supply on the thermal state of the combustion zone of burner devices.

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