INFRARED BURNER DEVICE ON A SYSTEM OF RECUPERATIVE ELEMENTS

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Abstract: Experimental studies on combustion of natural gas – air mixtures in the infrared burner device containing the system of recuperative elements made of heat-resistant metal alloy Cr25Al6 have been performed. The height of recuperative elements varied from 18 to 70 mm. This design of the burner allowed obtaining a stable combustion mode at the flow rate of the gas–air mixture prior to ignition approximately 5 times higher than the normal combustion rate of this mixture. The surface temperature of the recuperative elements coated with aluminum oxide reached the value of 1450 °C, the radiation efficiency of the burner was higher than 30%. The stable combustion mode is realized in the range of specific burning power values up to 5.3 MW/m^2 (per unit cross-sectional area of the gas flow). The maximum power of the burner is 16 kW; the concentration of nitrogen oxides in the combustion products is up to 14 ppm; and the concentration of carbon monoxide is up to 20 ppm at an air-to-fuel equivalence ratio of 1.4.

Keywords: surface combustion; radiation burner; recuperative elements

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Figure Captions

Figure 1 Diagram of the experimental apparatus: *1* — burner housing; *2* — mixer; *3* — gas flow distributor; *4* and *5* — system of recuperative elements; *6* — gas flow meter; *7* — air flow meter; *8* — thermocouple; *9* — convertor; *10* — gas analyzer; and *11* — infrared pyrometer

Figure 2 Photograph of the flow structure in the gaps between recuperative elements of the infrared burner

Figure 3 Photograph of the system of recuperative elements at a specific combustion power of 3.6 MW/m^2; $\alpha = 1.4$; height of the recuperative elements is 60 mm

Figure 4 Concentrations of carbon monoxide (*1*) and nitrogen oxides (*2*) in the combustion products at the exit from the system of recuperative elements for different values of the system height. Air-to-fuel equivalence ratio is 1.4

Figure 5 Concentrations of carbon monoxide (*1*) and nitrogen oxides (*2*) in combustion products at the exit from the system of recuperative elements with a height of 60 mm for different values of air-to-fuel equivalence ratio excess coefficient

Figure 6 Temperatures of the upper part of the recuperative elements with a height of 45 (*1*) and 70 mm (*2*) for different values of air-to-fuel equivalence ratio

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