

## STUDY OF THE INFRARED GAS HEATERS CHARACTERISTICS UNDER FORCED SURFACE COMBUSTION MODES

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**Abstract:** Experimental studies of the combustion process of natural gas and air mixtures have been carried out on laboratory models of a gas infrared heater (GIH) operating in forced surface combustion (FSC) modes. The combustion process took place near the surface of the plates made of heat-resistant metal alloy (Ni 25%, Al 6%, Fe base). The design of the GIH models and the FSC mode allowed the authors to implement the stable surface combustion modes in the range of values of the firing rate from 2.15 to 7.55 MW/m<sup>2</sup> per unit cross-sectional area of the gas flow. The experiments were carried out on two models. Dimensions of the system of radiating plates of the first model are: width 78 mm; length 92 mm; and height from 110 to 250 mm. Dimensions of the radiating surface of the second model are: width 78 mm; length 92 mm; and height 403 mm. Combustion power in the models of the GIH varied in the range from 12 to 42.2 kW. The concentration of nitrogen oxides in the combustion products was less than 16 ppm and the concentration of carbon monoxide was less than 10 ppm at the values of the air-to-fuel equivalence ratio 1.5. The maximum temperature of the outer surface of the radiating plates was 1280 °C. The coefficient of conversion of combustion energy into radiation energy for the model of the GIH with a height of 403 mm reached the values exceeding 40%.

**Keywords:** surface combustion; radiation burners; gas infrared heaters

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### Figure Captions

**Figure 1** Photograph of the first GIH model (the maximum height of the plates is 250 mm) operating in the FSC mode

**Figure 2** The layout of the main plates of the GIH model made of kanthal above a square stainless-steel tube. Dimensions are in millimeters

**Figure 3** Concentrations of carbon monoxide (*a*) and nitrogen oxides (*b*) in combustion products at a distance of 110 (*1*) and 208 mm (*2*) from the lower edge of the kanthal plates

**Figure 4** The temperature of the combustion products at distances of 110 (*1*) and 208 mm (*2*) from the entrance to the plate system of the first GIH model and 403 mm (*3*) for the second GIH model

**Figure 5** Photograph of the second GIH model (height 403 mm) operating in the FSC mode

**Figure 6** The values of  $Q_2/Q_1$  ratio for different values of the specific combustion power for the first (*1*) and for the second GIH models (*2*)

### Table Caption

Gas heaters technical characteristics of Sibschwank Joint Stock Company

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