ONE-DIMENSIONAL MODEL OF COMBUSTION OF METHANE–AIR MIXTURE IN THE SLOT BURNER

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Abstract: An analysis of a one-dimensional model of combustion of methane–air mixture inside a plane-parallel channel of a slot burner consisting of a number of parallel metal plates is performed. Mathematically, the problem is described by a system of equations representing the laws of conservation of chemical components, energy in gas and solid phases, and mass. The limits of the range of specific power values in which it is possible to stabilize the flame inside the channel due to radiation from the surface of the plates forming it are determined. The model qualitatively describes the main combustion patterns in a slot burner.

Keywords: combustion of methane–air mixture; slot burner device; stabilization of flame; computer simulation

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Figure Captions

Figure 1 Designations for the calculation of processes in a single burner channel: *1* — channel; and *2* — plates

Figure 2 Distribution of temperature in gas (*1*) and plates (*2*) along the channel obtained in the present work (solid curves) and in [9] (dashed curves) at $w = 240$ W/cm^2

Figure 3 Distribution of concentrations (mole fractions) of CH_4 (*1*), O_2 (*2*), CO (*3*), CO_2 (*4*), H_2O (*5*), and H_2 (*6*) along the channel at $w = 240$ W/cm^2

Figure 4 Dependence of the stationary flame front coordinate on the specific power of combustion

Figure 5 Distribution of radiation fluxes r_1 (*1*) and r_2 (*2*) along the channel at $w = 240$ W/cm^2

Figure 6 Dependence of gas mixture heating on the specific power of combustion ahead of the flame front (*1*), and temperatures of the input (*2*) and output (*3*) ends of the plate

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