INVESTIGATION OF THE INFLUENCE OF PARAMETERS OF OXYGEN–HYDROGEN AND OXYGEN–METHANE MIXTURES ON THE POSSIBILITY OF LASER IGNITION

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Abstract: The results of studies on the influence of the flow velocity and the oxidizer-to-fuel equivalence ratio in oxygen–hydrogen and oxygen–methane mixtures on the possibility of their laser ignition by initiating an optical breakdown spark in a gas volume are presented. Experimental data obtained during operation of a research chamber, the flow velocity in which was controlled both by varying the total consumption of fuel components and by changing the pressure in the attached exhaust chamber are provided. The results of numerical simulation of the mixing of components in the research chamber are presented for assessing the conditions of mixture formation. The threshold values of the flow velocity of the studied fuel mixtures revealed in the course of experiments are indicated for a wide range of changes in the value of the oxidizer-to-fuel equivalence ratio at which laser ignition is observed.

Keywords: laser ignition; optical breakdown; flow velocity; oxygen–hydrogen; oxygen–methane

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Figure Captions

Figure 1 Research chamber

Figure 2 Optical breakdown inside of the research chamber. Dimensions are in millimeters

Figure 3 Flow velocity distribution in the axial direction of the combustion chamber operating on oxygen–hydrogen fuel

Figure 4 Graphs of the flow velocity (*a*) and of the oxidizer-to-fuel equivalence ratio (*b*) of the oxygen–hydrogen (*1*) and oxygen–methane (*2*) components along the axis of the research chamber

Figure 5 Results of experiments on oxygen–hydrogen (*a*) and oxygen–methane (*b*) mixtures: *1* — ignition; and *2* — no ignition

Table Captions

Table 1 Laser ignition parameters

Table 2 Research chamber parameters for numerical simulation

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