DETONATION WAVE VELOCITY IN THE “LIQUID FUEL – OXIDIZER” MIXTURES AT $\varphi \leq 1$ IN A SMALL-SIZED PULSED COMBUSTOR*

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Abstract: Presented are new results of the experimental study of detonation wave initiation and propagation in a small-sized pulsed-jet combustor 664 mm long during combustion of heterogeneous heptane–oxygen–air fuel-lean ($\varphi < 0.8$) and near-stoichiometric ($\varphi \approx 1.0$) mixtures. It is found that when a lean mixture ($\varphi = 0.79$; $[O_2/\text{air}] = 0.70$) is used, detonation does not occur. Generation of detonation waves is possible when a stoichiometric mixture is used with an equivalence ratio of about one, despite the lower oxygen content in the mixture ($[O_2/\text{air}] = 0.63$). In this case, the deflagration-to-detonation transition is possible at a distance sufficiently close to the spark plug (250–300 mm).

Keywords: detonation; wave velocity; equivalent ratio; oxygen-to-air ratio

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Figure Captions

Figure 1 General view of a small-sized pulsed combustor suspended on a pendulum

Figure 2 Registration of the pulsed combustor operation parameters: *1* — oxygen flow rate; *2* — air flow rate; *3–6* — signals of pressure sensors Nos. 2, 3, 4, and 6; *7* — strobe; and *8* — thrust sensor signal

Figure 3 Dynamics of wave velocity along the detonation tube for a series of 10 successive pulses during combustion of fuel-lean ($\phi = 0{,}785$) (*a*) and stoichiometric ($\phi = 1{,}023$) (*b*) mixtures (process frequency 10 Hz)

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