DETERMINATION OF THE AUTOIGNITION DELAY OF METHANE–ETHYLENE–AIR MIXTURES

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Abstract: The autoignition delays of stoichiometric methane–ethylene–air mixtures in the initial temperature range $T_0 = 800–1000$ K and at a pressure $P_0 = 1$ atm were determined experimentally by the method of autoignition in a static reactor and by kinetic modeling. It is experimentally established that as the concentration of ethylene in the mixture increases, the effective activation energy of the autoignition delay increases. On the basis of comparison with the delay of spontaneous ignition of methane–ethane–air mixtures, it is concluded that the detonation resistance of C_2–C_3 alkenes, including their mixtures with methane, does not exceed the detonation resistance of the corresponding alkanes.

Keywords: methane; ethylene; ethane; autoignition delay

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Figure Captions

Figure 1 Temperature dependence of the autoignition delay of stoichiometric methane–ethylene–air mixtures; $P_0 = 1$ atm. Concentration of ethylene in the mixture with methane: *1* — 0 %(vol.); *2* — 5; *3* — 10; *4* — 20; *5* — 40; *6* — 60; *7* — 80; and *8* — 100 %(vol.)

Figure 2 Dependence of the effective activation energy of the autoignition delay of stoichiometric methane–ethylene–air mixtures on the concentration of ethylene in the range of initial temperatures 800–1000 K at $P_0 = 1$ atm: *1* — experimental results; and *2* — results of kinetic modeling

Figure 3 Dependence of the autoignition delay of stoichiometric methane–ethylene–air mixtures on the concentration of ethylene at $P_0 = 1$ atm and initial temperatures: *1* — 850 K; *2* — 900; *3* — 950; and *4* — 1000 K

Figure 4 Comparison of the dependence of the autoignition delay of stoichiometric methane–ethane–air (*1*) and methane–ethylene–air (*2*) mixtures on the concentration C of ethane or ethylene at $P_0 = 1$ atm and $T_0 = 950$ K

Table Caption

Octane numbers of C_2–C_5 hydrocarbons of normal structure according to the motor (MON) and research (RON) method [11]

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