EFFECT OF PRESSURE ON 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 $T_0 = 750$–1000 K and at a pressure $P_0 = 1$ and 3 atm were determined experimentally by the method of autoignition in a static reactor and by kinetic modeling. It was found that increasing the pressure reduces the autoignition delay without changing the general nature of its dependence on the concentration of ethylene in the mixture. The effective activation energy of the autoignition delay of methane–ethylene–air mixtures within the measurement error weakly depends on pressure which is confirmed by kinetic calculations. The calculated values of the effective activation energy are in a good agreement with the experimental results.

Keywords: methane; ethylene; ethane; autoignition delay

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Figure Captions

Figure 1 The dependence of the autoignition delay of stoichiometric methane–ethylene–air mixtures on the concentration of ethylene at $T_0 = 850$ K and $P_0 = 1$ (*1*) and 3 atm (*2*). Signs — experiments and curves — calculations using AramcoMech3.0 (2018) [7]

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

Figure 3 The dependence of the effective activation energy of the autoignition delay of stoichiometric methane–ethylene–air mixtures on the concentration of ethylene in the fuel: *1* — $P_0 = 1$ atm; and *2* — $P_0 = 3$ atm (this work). Solid symbols and curves — experiment and blank symbols and dashed curves — calculations by AramcoMech3.0 (2018) [7]

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