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MEASUREMENT OF ACTIVATION ENERGY OF METHANE-AIR MIXTURE BY THIN-FIBER PYROMETRY*

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In this work, activation energy measurements have been carried out for various methane-air mixtures by thin-fiber pyrometry. The experimental installation is a flat porous burner from which a gas mixture flows, a filament of silicon carbide (d=15μm) is placed parallel to the plane of the burner, and a thermal imager OPTRIS PI is used to detect the temperature of the gas. According to the formula [1]

$$M = A \exp\left(-\frac{E_a}{2RT}\right), \quad (1)$$

where M – gas flow rate which was measured by Bronkhost Elflow controllers, E_a – activation energy, T – gas temperature. The temperature of the filament T_f was recalculated to the gas temperature T_g according to the formula [2]

$$T_g = T_f + \frac{\varepsilon\sigma {T_f}^4}{h_c}, \quad (2)$$

where ε – emissivity, σ – Stefan-Boltzmann constant, h_c – the coefficient describing the heat exchange of the filament and the gas.

The results of the experiment are compared with the numerical calculation made within the detailed reaction mechanism model GRI3.0 [3], and they are found to agree within the measurement error.

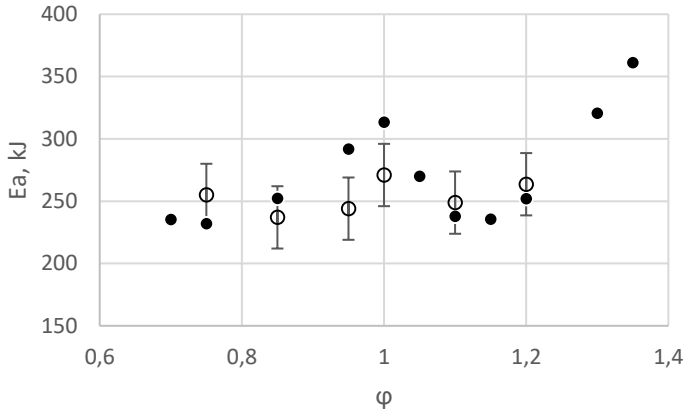

Fig.1. Activation energy for different concentrations of methane in the mixture. Black dots are numerical calculations, white dots are experimental data.

The data were also compared with the literature [4]. The prospects of further investigation are discussed.

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