ANALYSIS OF METHODS FOR CALCULATING THE KINETICS OF CHEMICAL REACTIONS UNDER ADIABATIC COMPRESSION–EXPANSION

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Abstract: The methods of kinetic processing of experimental data obtained in free piston compressors (ballistic compressors) are analyzed. Among them are various techniques based on the joint solution of a system of equations consisting of the piston motion equation, Poisson's adiabatic equation, the law of conservation of energy, and the equation of state; techniques based on measuring the deviation from adiabaticity during compression of concentrated mixtures, an approximate technique developed at the A. V. Topchiev Institute of Petrochemical Synthesis of the Russian Academy of Sciences (TIPS RAS) as well as a method for determining kinetic constants during spontaneous ignition of a combustible gas proposed by Babkin and Senachin. It has been shown that at present, for adiabatic compression of gases by a free piston, there is no method for determining the rate of a chemical reaction based on experimental data in the full range of the conversion degrees of the test substance and, consequently, in a wide temperature range. The most promising way to create it is to improve the methodology of the TIPS RAS.

Keywords: adiabatic compression; ballistic compressor; free piston compressor; kinetics; method

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Figure Captions

Figure 1 Pressure–time histories for experiments with different values of maximum pressure $P_{\max}$

Figure 2 Arrhenius plot for summary rate constants of n-butane decomposition: *1* — data [5] calculated by the method [24]; *2* — data [25]; and *3* — data [26]

Table Caption

Kinetic parameters of the reaction $N_2O \rightarrow N_2 + O^*$

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