THE STUDY OF KINETICS CF$_2$ RADICAL FORMATION AT THE PYROLYSIS OF CF$_3$H BEHIND SHOCK WAVES

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Various halogenated hydrocarbons are widely used for the fire fighting [1-4] Trifluoromethane is considered to be one of the most promising inhibiting additives to methane-air, hydrogen-air and other gas mixtures [2]. Combustion suppression efficiency occurs not only from its endothermicity during pyrolysis, when the temperature of mixture decreases rapidly, but also due to chemical inhibition of chain combustion reactions [2-3] It is assumed that CF$_2$ is a primary product of trifluoromethane dissociation and is responsible for the suppression of the chain reactions of combustion. However, as it was shown in the papers [4], under certain conditions, such additive is not only inhibits the combustion and can even accelerate the ignition of the hydrocarbon-oxygen mixtures. Therefore, for possible practical application of CF$_3$H as an inhibitor additive it is necessary to study the kinetics of CF$_2$ radical formation at the pyrolysis CF$_3$H in a wide range of temperatures, pressures and concentrations of initial components. The study of the kinetics CF$_2$ radical formation using the method Molecular Resonance Absorption Spectroscopy (MRAS) were performed behind shock waves in UV range at a wavelength $\lambda=251.9$ nm. More than 80 successful experiments in the temperatures range of $1180 \leq T \leq 2780$ K and pressures $1.5 \leq P \leq 16$ Bar behind reflected shock waves were carried out. The initial concentration of CF$_3$H in argon was varied from 0.0038 to 2.7%. As a source of radiation line of CF$_2$ radical the microwave discharge lamp with the mixture of 1% CF$_3$H in He at the pressure of 6 mbar was used. From the experimental data the temperature dependencies of the equilibrium constant and the dissociation rate constant of CF$_3$H were determined at different pressures. The experimental results are compared with the kinetic modeling of the thermal decomposition of CF$_3$H at different temperatures and pressures using Chemkin-4.

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