Shock tube study of the kinetics of ammonia pyrolysis at high Ar dilution conditions by the method of absorption spectrometry

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Ammonia is widely used in industry, has a developed production infrastructure and is relatively close in physical properties to liquefied natural gas, which is frequently used as a fuel. In recent years, ammonia has also attracted much attention as a carbon-free fuel and an excellent chemical carrier of hydrogen, solving issues related to the safety of its storage and transportation. However, the problem of low reactivity and the formation of NO_x oxides during combustion of ammonia, has not yet been finally solved. In this regard, the study of the fundamental aspects of pyrolysis and combustion of NH_3 remains an actual task. This work is aimed at clarifying the kinetics of high-temperature pyrolysis of ammonia. The experiments were carried out in a shock tube behind reflected shock waves and covered the range of 2000–3300 K at a pressure of 2–3 bar. To study the decomposition reactions of ammonia, highly diluted mixtures were used (700–3000 ppm NH_3 in Ar). Registration of NH_3 absorption profiles was first realized by the method of absorption spectrometry at a wavelength of 130.5 nm. To transform the obtained data into concentration profiles of NH_3, its absorption cross-section at 130.5 nm was also measured for the first time. Thus, the implemented experimental technique allowed not only to measure the kinetics of NH_3 pyrolysis, but also directly took into account adsorption of ammonia on the walls of the shock tube, that is extremely important when working with highly diluted ammonia-containing mixtures. This work was supported by RSCF grant №24-19-00165.