SOOT FORMATION AT HIGH-TEMPERATURE ETHANOL PYROLYSIS

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Soot formation during the pyrolysis of ethanol behind shock waves under oxygen-free conditions was studied for the first time. Simultaneously measuring the optical absorption and emission of soot particles made it possible to determine the time evolution of the soot yield and soot particle temperature. The soot yield was found to be very small and strongly temperature-dependent. The temperature of soot particles was shown to be substantially lower than the initial temperature of the gas behind the reflected shock wave.

The traditional scheme for describing soot formation from hydrocarbons was extended to incorporate the reactions characteristic of ethanol decomposition. The scheme was validated by simulating the ignition delay time for ethanol – oxygen – inert gas mixtures.

The predictions of the scheme proved to be in close agreement with the experimental results on soot yield for the 5 percent ethanol–argon mixtures. For the 3 percent ethanol–argon mixture, a significant deviation of the calculated from measured values was observed, a discrepancy that was explained by uncertainties in knowledge of the kinetic characteristics of the initial step of ethanol decomposition. At the same time, the model was demonstrated to closely describe the temperature drop accompanying soot formation during ethanol pyrolysis.