Experimental investigation of PAHs formation during pyrolysis of hydrocarbons

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Polycyclic aromatic hydrocarbons (PAHs) are formed from incomplete combustion processes and are generally considered as precursors for soot particles. Precise measuring PAHs formation and growth is significant for better understanding and developing of soot formation kinetics. According to the literature data [1], the maximum wavelength of PAHs absorption depends on its size. Therefore, it is possible to monitor the evolution of PAHs growth by measuring the absorption at different wavelengths. In this investigation, temperature dependences of optical density have been measured during shock wave pyrolysis of acetylene, ethylene and benzene diluted in argon at different wavelengths and reaction times. Various hydrocarbons were chosen in order to identify the dependence of PAHs formation on fuel mixture. The obtained temperature dependences of optical densities at 285, 313, 405 and 633 nm of investigated mixtures represented a well-known "bell" shape. It was observed the strong endothermic effects due to heat consumption on pyrolysis of chosen hydrocarbons, which led to a shift in the temperature dependencies. The magnitude of the maximum optical density observed at 285/313 nm is larger than it for 405 nm, due to both different concentrations of absorbing molecules in these range, and the overlap of absorption spectra from different PAHs in the region of 350-450 nm. The largest amount of PAHs has formed during benzene pyrolysis because of its cyclic structure.

[1] Bauer J F *et al* 2021 *Applied Physics B* **127** 115