Soot and polycyclic aromatic hydrocarbons formation in hydrocarbons pyrolysis

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Soot particles and its precursors polycyclic aromatic hydrocarbons (PAHs) are objects of great concern due to their impact on a global warming and causing cancer [1, 2]. Studying the processes of soot formation from gas-phase is extremely challenging task due to presence of different intermediate components in the mixture simultaneously. Absorbing spectra tends to expand towards larger wavelengths with increasing of molecular mass of absorbing PAH species [3], so measuring absorption on different wavelengths can help to trace formation of PAHs and condensed soot particles.
In the present work, the temperature dependences of optical density were measured during shock-wave pyrolysis of methane, ethylene, benzene and acetylene diluted in argon at wavelengths 313, 405 and 633 nm. Using the data from the literature on soot particles optical properties in uv and visible region of spectra the contributions of condensed carbon particles in total absorption were estimated. The highest yield of PAHs and soot was observed in the pyrolysis of benzene, the lowest in the pyrolysis of methane and ethylene. It is noted that the maximum yield of PAHs and soot in the case of acetylene pyrolysis is significantly shifted in temperature relative to other hydrocarbons. This work was supported by the Russian Science Foundation (project No. 23-19-00407).

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