Peculiarities of Soot Formation During Ethylene Pyrolysis

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Numerical methods are being actively developed to make it possible to predict soot formation under various conditions. Experimental data obtained during hydrocarbons pyrolysis in shock tube serves as a useful data for the combustion kinetic mechanisms validation at high temperatures. In this study, the features of soot formation at various pressures (6-26 bar) and carbon concentrations of 2.8-3.8 mol/m^3 during ethylene pyrolysis have been experimentally and numerically investigated. The diagnosis of the soot formation was carried out using the laser extinction method at 633 nm.
It have been shown by kinetic calculations that a significant drop in the mixture temperature, which determined by the initial pyrolysis reactions, varies at different pressures. At low pressures (above 6 bar) the soot yield maximum shifts to a high temperatures region. The pressure effect on the soot yield magnitude during ethylene pyrolysis was observed only in [1] at pressures above 25 bar; in this study the soot yield dependence on pressure in the investigated range of 6-26 bar was not observed. Kinetic modeling shows that the ethylene decomposition channels are independent of pressure. Thus, the reasons for the change in the temperature drop magnitude at different pressures observed in experiments most likely consists in changing of the kinetics of the initial stage of ethylene pyrolysis.
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[1] Bauerle S et al 1994 *25th Symp (Int.) on Combust.* 627–634