Thermal Decomposition of RP-1, RP-2, and Mixtures of RP-2 With Stabilizing Additives

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The thermal decomposition of RP-1, RP-2, and mixtures of RP-2 with three different additives has been investigated. The mixtures were RP-2 with 5 % 1,2,3,4-tetrahydronaphthalene (tetralin), RP-2 with 5 % 1,2,3,4-tetrahydroquinoline (THQ), and RP-2 with 256 mg/L of the additive used to make JP-8+100. Decomposition reactions were performed in stainless steel ampoule reactors at 375, 400, 425, and 450 °C. All of the reactions were run with an approximate initial pressure of 5000 psi (34.5 MPa). After each reaction the extent of decomposition was determined by analyzing the sample by gas chromatography. At each temperature, the kinetics of decomposition was determined by monitoring the increase in a suite of light decomposition products as a function of time. These data were used to derive global, pseudo-first-order rate constants that approximate the overall decomposition rate of the mixture. For RP-2, decomposition rate constants ranged from 1.33×10^{-5} s^{-1} at 375 °C to 5.47×10^{-4} s^{-1} at 450 °C. The rate constants for RP-1 decomposition were not significantly different. These rate constants are useful for planning property measurements at high temperatures because they can be used to calculate allowable instrument residence times. The kinetic data were also used to derive Arrhenius parameters for the decomposition of RP-1 and RP-2. The presence of additives had a significant effect on the rate of decomposition. For example, the addition of 5 % THQ slowed the decomposition by an order of magnitude, while the addition of 5 % tetralin slowed the decomposition by only about 50 %.