A TWO-STEP REACTION MECHANISM FOR COMBUSTION OF POLYMETRIC SOLIDS CONTAINING FLAME RETARDANTS

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Recent advances in Microscale Combustion Calorimetry (MCC) allow the combustion gases, O_2, CO, and CO_2 to be measured using in-line analyzers. A simplified two-step reaction mechanism, which involves a CO generation step and a CO oxidation step, was proposed to better describe the chemical reaction scheme that generates these products within the pre-mixed combustor. Different incomplete combustion conditions were obtained by varying the MCC combustor temperature, and a numerical model of the combustor was developed to simulate the species evolution. Kinetics parameters for both reactions were found by minimizing the error between the predicted species concentrations (O_2, CO, and CO_2) and the measurements. The two-step method was employed to examine halogen- and phosphorous-containing polymers of known compositions. The halogen additives were found to have a significant effect on the gas phase reactions, whereas the effect of phosphorous was found to be relatively small. The MCC pre-mixed kinetic parameters were also used to correlate combustion of the same polymers in a diffusion flame in the cone calorimeter.