High-pressure pyrolysis and oxidation of DME and DME/CH₄

The pyrolysis and oxidation of dimethyl ether (DME) and its mixture with methane were investigated at high pressure (50 and 100 bar) and intermediate temperature (450–900 K). Mixtures highly diluted in nitrogen with different fuel–air equivalence ratios (Φ=∞, 20, 1, 0.06) were studied in a laminar flow reactor. At 50 bar, the DME pyrolysis started at 825 K and the major products were CH₄, CH₂O, and CO. For the DME oxidation at 50 bar, the onset temperature of reaction was 525 K, independent of fuel–air equivalence ratio. The DME oxidation was characterized by a negative temperature coefficient (NTC) zone which was found sensitive to changes in the mixture stoichiometry but always occurring at temperatures of 575–625 K. The oxidation of methane doped by DME was studied in the flow reactor at 100 bar. The fuel–air equivalence ratio (Φ) was varied from 0.06 to 20, and the DME to CH₄ ratio changed over 1.8–3.6%. Addition of DME had a considerable promoting effect on methane ignition as the onset of reaction shifted to lower temperatures by 25–150 K. A detailed chemical kinetic model was developed by adding a DME reaction subset to a model developed in previous high-pressure work. The model was evaluated against the present data as well as data from literature. Additional work is required to reconcile experimental and theoretical work on reactions on the CH₃OCH₂OO PES with ignition delay measurements in the NTC region for DME.