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Dynamics of autoignitive DME/air coflow flames in oscillating flows SILI DENG, Princeton University, PENG ZHAO, Oakland University, MICHAEL MUELLER, CHUNG LAW, Princeton University — The structure and dynamics of laminar nonpremixed dimethyl ether (DME)/air coflow flames were investigated at elevated temperatures and pressures, conditions at which autoignition times become competitive with flame times. Computations with detailed chemistry were performed for DME and heated coflow air at 30 atm with uniform but sinusoidally oscillating inlet velocities. These unsteady cases were compared with steady flames to elucidate the effect of oscillation frequency on the flame dynamics. In the oscillating reacting flow, periodic but hysteretic transition occurs between a multibrachial autoignition front that locates downstream at high inlet velocity and a tribrachial flame that locates upstream at low inlet velocity. The finite induction time for autoignition results in this hysteretic behavior, which diminishes at lower oscillation frequency as there is more time for chemistry to respond to the hydrodynamic changes and consequently approach steady state.

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