Flow Reactor Studies of Surrogate Jet Fuel Reaction Kinetics

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- Project Objectives
- Experimental Techniques
- Application to Fuel Kinetics Studies
- Future Directions: Flow Reactor Research

Sponsor: AFOSR/USC
Long-Term Stanford Program Objectives

- Build an accurate, multi-target, multi-species experimental database for combustion of *practical jet fuels and surrogates* utilizing a flow reactor and shock tubes.

- Collaboratively develop, evaluate and refine *detailed kinetic mechanisms* for single-component fuels, multi-component surrogate blends, and practical fuels to establish *predictive capabilities* for the kinetics of current and future jet fuels.
Experimental Conditions

- Initial temperatures: 1000 – 1300K
- Pressures: 1 – 20 atm
- Initial n-dodecane: 300 – 3000 ppmv
- Stoichiometry: $\Phi \sim 0.2 - 2.0$
- Residence times: 20 – 150 msec
Fuel Evaporator
Example Results – $\text{C}_2\text{H}_6$

$P = 6 \text{ bar}$ \hspace{1em} $T = 1075 \text{ K}$

1750 ppm $\text{C}_2\text{H}_6$ \hspace{1em} 7.0% $\text{O}_2$

Supported by the Stanford Global Climate and Energy Project
• Single mixing parameter is determined experimentally
Accomplishments/Future Work

- Fuel evaporator designed, fabricated and tested – no fuel decomposition observed for evaporator temperatures below 150°C.
- Selected and calibrated GC column for n-dodecane.
- Initial experiment to overlap conditions of the Drexel flow reactor experiment but at a temperature of 1100K.
- Flow reactor conditions also overlap the conditions of the Stanford shock tube experiments and will provide complementary data.