Combustion Science & Engineering Inc

Fuel Chemistry and Chemical Kinetics: Capabilities and Services

Detailed fuel chemistry for a wide variety of fuels

- Natural gas, LNG, jet fuels, renewable jet fuels, solid fuels
- Includes low-temperature oxidation reactions, vitiated combustion kinetics, and full nitrogen chemistry (for NOx prediction under ultra-lean conditions)
- Validated for ignition flame speed and emissions against experimental data

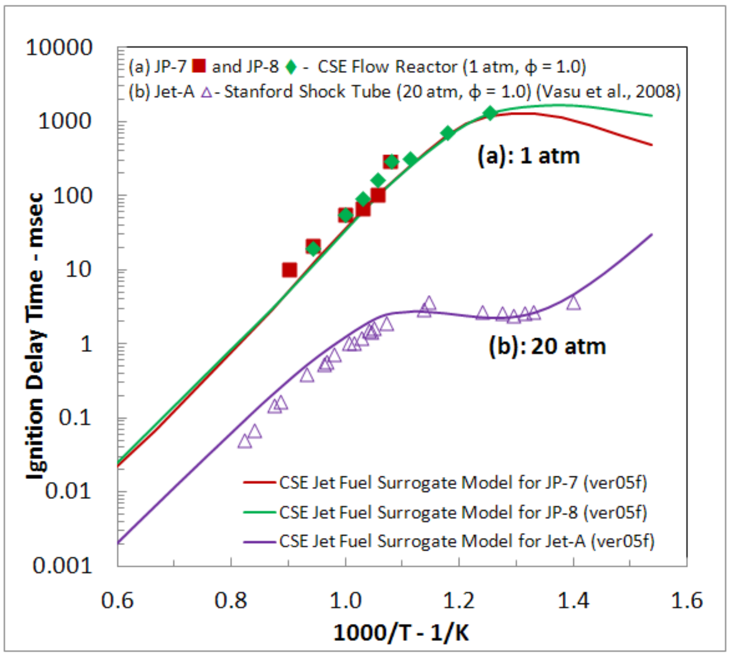

Figure 1. CSE detailed surrogate kinetic mechanism for jet fuel combustion compared with ignition delay time data

rkmGen™ – Proprietary optimization package for reduced chemical mechanisms

- Size of the mechanism (number of reactions) may be user-specified
- Optimized against target data that may include ignition delay time, blow-out, flame speed, and emissions
- Suitable for CFD simulation of gas turbine combustors, augmentors and scramjets to predict flame instability and emissions

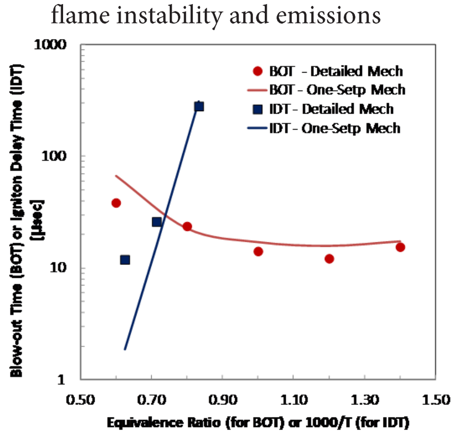

Figure 2. One-step ethylene kinetic model predications for ignition (IDT) and blow-out (BOT) compared with GRI-3.0 mechanism

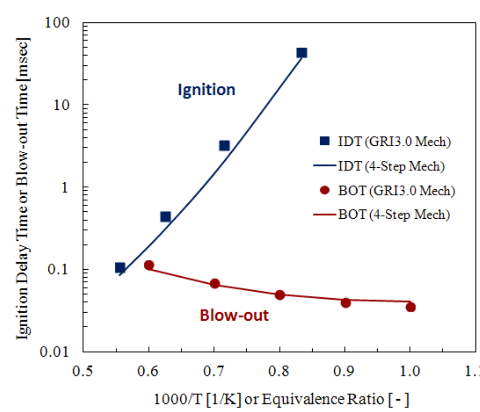

Figure 3. Four-step global mechanism for methane optimized for ignition and blow-out

Expertise

- Combustion Design & Dynamics
- Combustion Modeling & Problem Analysis
- Fuel Efficiency
- Emissions Reduction
- Particulate Control
- Fuel Chemistry
- Fire Safety
- Fire Investigation
- Explosion Analysis

Industries

- Utilities
- Oil & Gas
- Chemical & Industrial Process
- Aviation & Defense
- Manufacturing

Experimental Facilities

- *Flow Reactor*: Ignition-delay time
- *High-Pressure Burner*: Blow-out and emissions measurements
- *Atmospheric Pressure Test*: Rigs with air flow to 0.5 kg/s
- *CEMS*: CO, CO_2, NO_x, O_2, and THC
- *GC-MS and GC-BID*: Hydrocarbon species measurements
- *Spectrometers*: FTIR and Visible/UV

Please contact us to discuss your project requirements
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1-D models of fuel transformation from pre-heat to combustion

- Physical models for multi-component evaporation of real fuels such as Jet-A, diesel, etc.
- Chemical kinetic models for pyrolysis and combustion
- Chemical reactor network models for emission (e.g.,NOx and CO) analysis using detailed chemistry

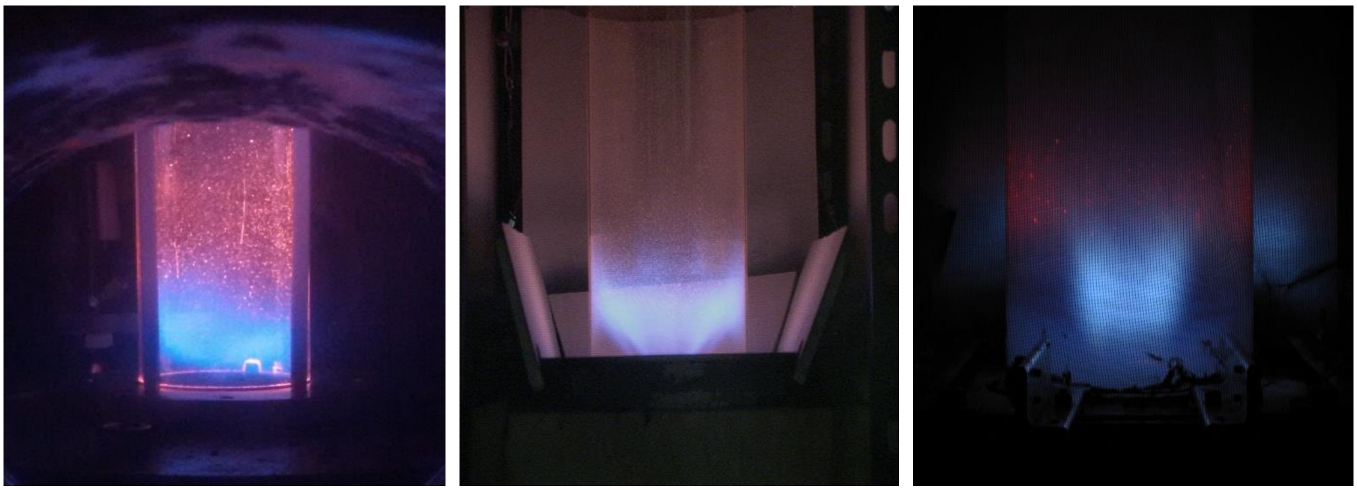

Figure 4. Measurements of pollutant emissions from premixed flames in CSE's laboratory

Detailed kinetic models for fuel pyrolysis (thermal cracking) and oxidative cracking

- Prediction of gas-phase and surface-phase deposition
- Prediction of low temperature fuel modification and particulate formation

Extensive Experimental Facilities (see side bar)

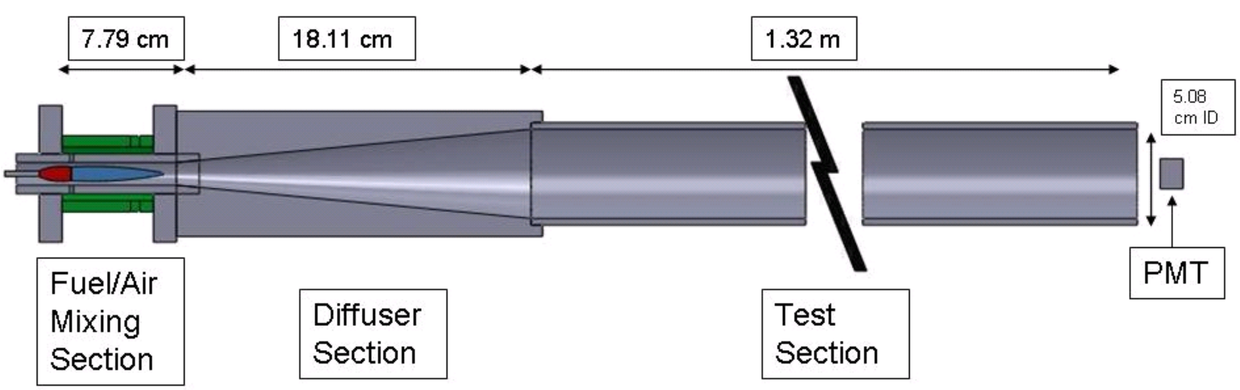

Figure 5. Schematic of CSE flow reactor facility for ignition delay time measurements