Effect of Oxygenated Fuels on Soot From Diesel Spray

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Motivation and Objectives

- Investigating the effect of oxygenated fuel properties on combustion and soot formation
  - Simulations were performed to compare the oxygenated fuels and to give more insights between soot formation and an oxygenated fuel's molecular structure.

Methodology

- Simulation Conditions: ECN ‘Spray A’ condition
  - Ambient conditions: 22.8 kg/m³ / 800-1200 K / 15 % O₂
  - Fuel mass / temperature: 18 mg / 363 K
  - Injection pressure: 150 MPa
  - 3D CFD code: KIVA-ERC with Chemkin
  - Soot model: multi-step soot model + PAH mechanism [Vishwanathan, 2011]

Results

- Effect of Fuel Molecular Structure on Soot
  - The formation of soot decreases with increased oxygen content in the fuel and with decreased the number of C-C bonds. Fuel molecular structure strongly affects soot formation in addition to fuel-air mixing.

- Comparison of Fuel Blends
  - The spray ignition delay and lift-off length control the soot formation for fuels with similar fuel oxygen ratio and the number of C-C bond.

Summary

- The effects of the oxygenated fuel properties on soot emissions were investigated.
  - The formation of soot decreases with increased oxygen content in the fuel and with decreased the number of C-C bonds. Fuel molecular structure strongly affects soot formation in addition to fuel-air mixing.
  - The spray ignition delay and lift-off length control the soot formation for fuels with similar fuel oxygen ratio and the number of C-C bond.