Study of the Oxidation of Branched Alkanes

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Overview

This project involves the measurement of ignition times and OH concentration time histories for several branched alkanes. Branched alkanes are important components of practical fuels; automotive gasoline contains approximately 30% branched alkanes. Ignition time data and OH concentrations are of importance to modelers attempting to model the combustion of practical fuels, as they provide targets for these models. These models are used to design and optimize combustion systems.

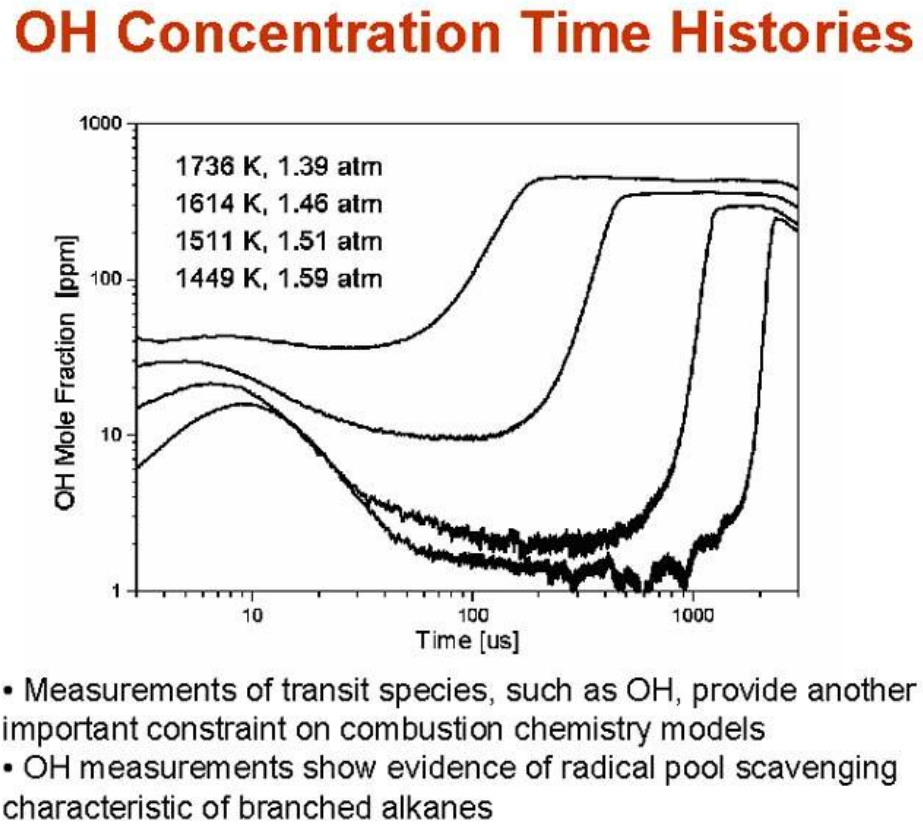

Figure 1: Typical experimental data

The fuel-oxidizer mixtures are ignited behind a shock wave in a pressure-driven shock tube, and a variety of advanced diagnostics are used to make measurements during the oxidation process. Ignition times are measured optically using an photodetector, filtered around 431 nm to monitor the emission of CH. OH absorption is measured using the frequency doubled output of a ring-dye laser around 306 nm. To our knowledge, there have been no other measurements of transient species, such as OH, during the oxidation of branched alkanes. Information about the transient radical pool, which strongly governs the ignition process, is critical as another target for the modeling of hydrocarbon oxidation. Branched alkanes, unlike n-alkanes, exhibit strong radical scavenging, primarily of OH, during the induction period, see Figure. The radical scavenging process is well-known to reduce engine knock.

References

1. M.A. Oehlschlaeger, D.F. Davidson, J.T. Herbon, and R.K. Hanson: "Shock Tube Measurements of Branched-Alkane Ignition Times and OH Concentration Time Histories," International Journal of Chemical Kinetics, 36, 67-78 (2003).
2. M.A. Oehlschlaeger, D.F. Davidson, J.T. Herbon, and R.K. Hanson: "Shock Tube Measurements of Branched-Alkane Ignition Times and OH Concentration Time Histories," 41st Aerospace Sciences Meeting, Reno, Nevada; January 6 - 9, 2003.
3. D.F. Davidson, M.A. Oehlschlaeger, J.T. Herbon, and R.K. Hanson, "Shock Tube Measurements of Iso-Octane Ignition Times and OH Concentration Time Histories," 29th Int'l Symp. on Combustion (2002).