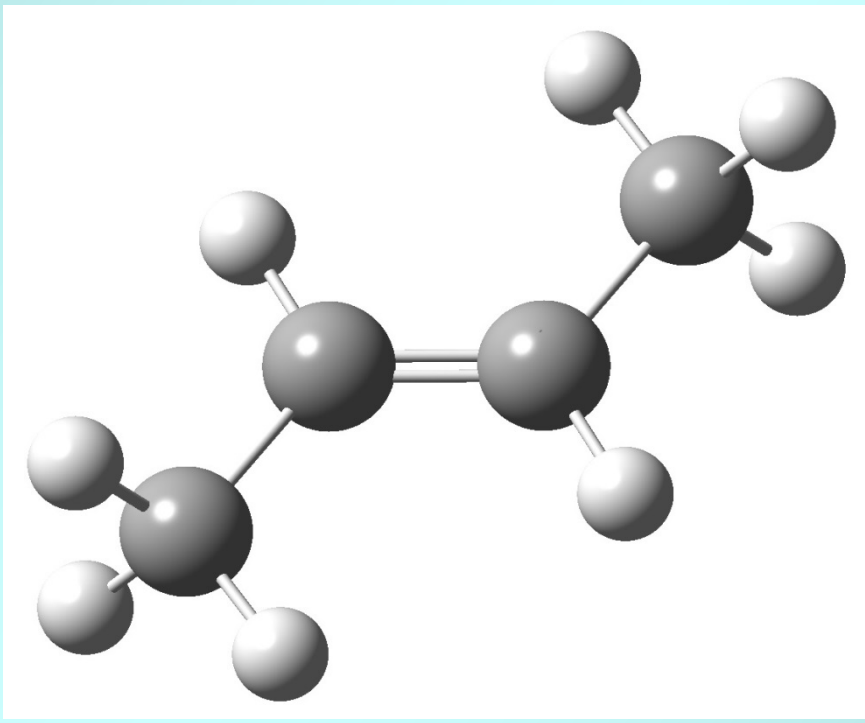
au programme des séminaires ICARE…

Experimental and kinetic modelling of trans-2-butene oxidation in jet-stirred reactor and combustion bomb

par

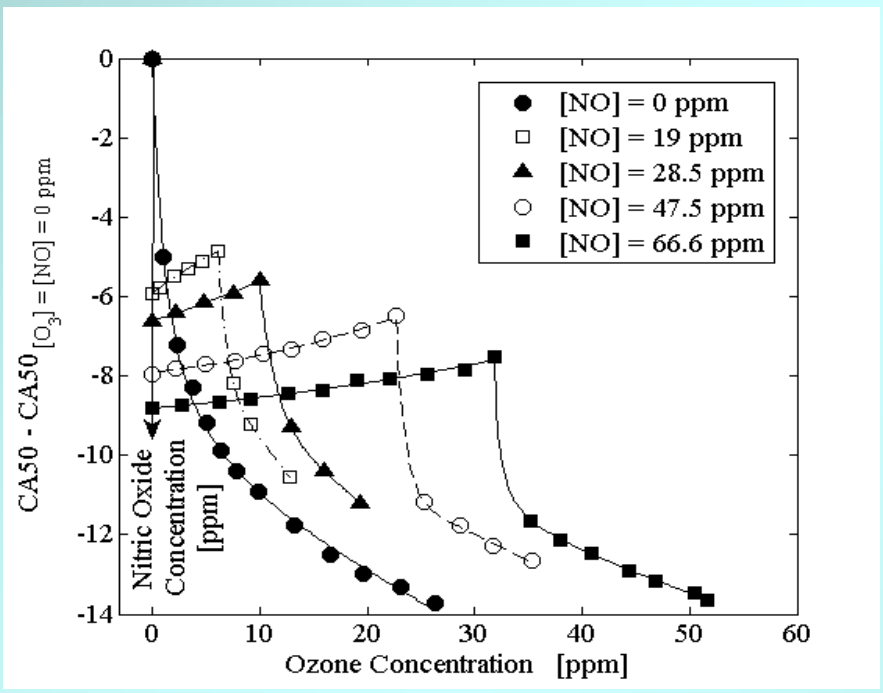
Yann FENNARD

Doctorant à ICARE



Butenes are intermediates ubiquitously formed by decomposition and oxidation of larger hydrocarbons (e.g. alkanes) or alcohols present in conventional or reformulated fuels. This study provides new complementary data for the oxidation of trans-2-butene. The oxidation of trans-2-butene was studied in two complementary experimental configurations. A jet-stirred reactor (JSR) was used in order to measure stable species concentration profiles for the oxidation of the fuel at atmospheric pressure over a range of equivalence ratios ($0.5 \leq \varphi \leq 2$) and temperatures (900-1450K). A combustion bomb apparatus was used to determine laminar flame velocities of trans-2-butene at 1 atm, 300K, and for equivalence ratios of 0.8-1.4. The oxidation of trans-2-butene was simulated under these experimental conditions using an extended detail chemical kinetic reaction mechanism (193 species involved in 1710 reactions). This mechanism is based on a previously proposed scheme for the oxidation of hydrocarbons. Good agreement with experimental data presented in this article was obtained which significantly improves kinetic modeling ability. The structure of a trans-2-butene premixed low pressure flat flame recently published was also successfully modeled. Sensitivity and reaction pathways analyses were performed to get insights into the processes involved in the oxidation of trans-2-butene.

le jeudi 17 juin 2014 à 10h30
salle de réunion ICARE



Shift of the CA50 as a function of the nitric oxide and ozone when simultaneously seeding the intake of the engine

Investigation of Iso-octane Combustion in a Homogeneous Charge Compression Ignition Engine Seeded by Ozone, Nitric Oxide and Nitrogen Dioxide

par

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The Homogeneous Charge Compression Ignition (HCCI) engine is well known as an alternative engine which could replace conventional engines (Spark Ignition (SI) and Combustion Ignition (CI) engines) in order to meet pollutant requirements and reduce fuel consumption. However, controlling this kind of combustion remains difficult and represents a real challenge. The present investigation focussed on the use of different oxidizing chemical species (ozone, nitric oxide and nitrogen dioxide) which can modify the chemical kinetic governing HCCI combustion. Experiments were conducted on a single cylinder HCCI engine fuelled with iso-octane, for constant engine parameters and for oxidizing species concentrations varying from 0 up to 100 ppm. These experimental results are coupled with kinetic analyses in a homogeneous constant volume reactor performed with a detailed kinetic mechanism. The effects of ozone, nitric oxide and nitrogen dioxide were initially studied and compared when they separately seed the intake of the engine. Results showed that all the molecules improve HCCI iso-octane combustion. The highest effect on CA50 phasing was observed for ozone while the lowest was for nitrogen dioxide. These results were confirmed and explained by a kinetic interpretation. HCCI experiments were then carried out with ozone and nitric oxide injected together in the intake of the engine. Experimental results show a combustion enhancement when these two molecules are present but a delay in CA50 phasing was observed for low ozone concentrations and a constant nitric oxide concentration until the ozone concentration becomes higher. A kinetic interpretation, through two-step computations, showed that there is a strong oxidizing reaction between nitric oxide and ozone, yielding nitrogen dioxide. Therefore, the presence of nitrogen dioxide can explain the CA50 delay observed due to its low effect among all the oxidizing chemical species studied

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