Collaborative Tasks: Alternative Fuels in Combustion

Studies on reaction kinetics of combustion and emission formation : Neat oxygenated compounds

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Objectives

The combustion of different oxygenated compounds considered as alternative fuel are studied in laminar premixed flat flames, at low pressure to evaluate pollutants concentration during their combustion.

Measurements of concentrations of chemical species throughout the flame front of premixed flammable mixtures are performed experimentally by molecular beam mass spectrometry or by gas chromatography. The aim of the work is to build a reaction mechanism taking into account the formation and the consumption of species detected in these flames.

The interest of understanding these combustion mechanisms lies in the possibility of predicting from initial experimental conditions, the formation and the composition of burned gases as well as the evolution of the concentrations of initial fuels and the intermediate species.

We so obtain precious information on the degrees and the rates of conversion of the reactants, the formation of pollutants, the effects of additives, etc…

Projects

Present and future experimental studies of neat oxygenated species:

$C_3H_8O_2$, $C_5H_{12}O_2$, C_2H_5OH, CH_3CHO, CH_3COOH

CH_2O (important intermediate in oxygenated species)

NH_3 (to bypass such difficulties in hydrogen combustion : storage and transport need specific techniques)

Triacetine ($C_9H_{14}O_6$), **Tripropionine** ($C_{12}H_{20}O_6$), **Tributyrine** ($C_{15}H_{26}O_6$):

Triglycerides obtained by esterification between glycerin and volatile fatty acid

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Elaboration of kinetic model to understand emission formation:

Conversion of reactants, formation of pollutants, effects of additives, etc…

Reduction of the kinetic model according to initial conditions

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Use of reduced mechanisms in industrial processes (engines, furnaces, boilers, …) to define the best operation conditions

Milestone Chart

Present and future experimental studies of neat oxygenated species:

$C_3H_8O_2$: From now to August 2010

$C_5H_{12}O_2$: From now to September 2010

C_2H_5OH, CH_3CHO, CH_3COOH: From now to October 2010

CH_2O: September 2010 – June 2011

NH_3: From now to January 2011

Tributyrine ($C_{15}H_{26}O_6$)**:** September 2010 – October 2011

Triacetine ($C_9H_{14}O_6$), **Tripropionine** ($C_{12}H_{20}O_6$): Starting October 2011

We are available to study some others oxygenated species from common projects in the Collaborative Task.

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