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How to pave the way for a cleaner environment?

Nowadays, the main energy sources in the world are non-renewable fossil fuels such as coal, petroleum, and natural gas. However, it is known that the combustion of fossil fuels emits a large amount of "greenhouse gas" CO_2 , SO_x and NO_x that form acid rain, and particulate matter. These harmful substances have seriously damaged the environment and threatened human health. What can we do to pave the way for a cleaner environment?



Figure 1: Go green and save the Earth¹.

One way to solve these problems is to find alternative fuels and study their fundamental combustion properties. Dimethyl ether (DME; $\text{CH}_3\text{-O-CH}_3$), which has similar physical and chemical properties to hydrocarbon fuels but lower NO_x emissions, can be regarded as an alternative fuel. Moreover, DME is a renewable fuel that can be produced from biomass. Therefore, due to the CO_2 emitted during the combustion process is compensated by the CO_2 absorbed from the atmosphere by plants during growing process, it also helps to reduce CO_2 emissions. This makes the use of bio-fuels sustainable. However, since DME is a newly discovered alternative fuel, the data that modelers can use to validate their chemical kinetic models is limited, resulting in poor predictions of existing models.

The aim of this work is to study the fundamental combustion characteristics of DME, including laminar burning velocity and NO concentration in the post-flame zone. The laminar burning velocity measured by heat flux method is an important parameter, it can not only analyze and predict the combustion performance of the engine, but also can be used to validate chemical kinetic models. And NO concentrations in the post-flame zone are also studied by laser induced fluorescence technique, because NO is an important air pollutant and NO concentrations also can be used to validate chemical kinetic models.

So far, we have not found a solution that can completely solve the combustion pollution. However, development of a chemical kinetic model of DME is currently underway in our group. If DME can be widely used in combustion devices in the future, these problems will be solved to a certain extent.

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¹ Siviglia, S. (2020). Go green with our Orlando used hybrid cars!. Retrieved 10 May 2020, from <http://usedcars.toyotaofclermont.com/2014/go-green-one-orlando-used-cars/>