Differences in the combustion of oxygenated hydrocarbons

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Almost 90% of the total word energy is provided in the combustion of fossil fuels, with the remainder being supplied by non-fossil fuel sources such as solar, nuclear, biomass and hydroelectric energy. The availability of crude oil is predicted to become limited in the future and oil prices will continue to increase.

The burning of fossil fuels is also known to produce harmful emissions, such as NOx, SOx and particulate matter (PM). Some of these have been associated with the global climate change and environmental problems such as acid rain and atmospheric pollution. Many governments now strongly support biofuels as one of many renewable technologies needed to reduce our dependence on hydrocarbons and to avert the worst of climate change. Within the European Union for example, the use of biofuels in concentrations of 5.75 – and possibly even 8% of all road transport fuel has been mandated. A 20% target is stated for 2020.

As a result there is a growing interest in the development of cleaner and more efficient alternative fuel sources with the high energy density of traditional fossil fuels that can be generated easily, burn efficiently and be less polluting. Brazil has led the way in the use of ethanol and has a mature biofuel industry that can compete with petrol on the free market. Butanol is another potential biofuel being considered as it has a larger energy density compared to ethanol, while others such as methyl esters and 2,5-dimethyl furan which can be produced from lignocelluloses and other fuels from algae. All of these fuels are oxygenated hydrocarbons having different functional groups be they alcohols, esters, ethers, aldehydes, ketones or carboxylic acids.

Thus, in developing renewable energy sources we need to understand the fundamental chemical processes controlling the combustion of molecules having varied functional group. We need to understand what effect the functional group has on fundamental combustion properties such as ignition delay time, flame speed and extinction strain rate. Some of these issues will be discussed in the current presentation.