On the effect of the addition of hydrogen on the ignition delays of natural gas inside a rapid compression machine

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Natural gas is usually considered as a clean and efficient automotive fuel. Its high H/C ratio offers the opportunity to reduce the CO_2 emission of vehicles, compared to traditional fossil fuels. These low CO_2 emissions can be further reduced by mixing natural gas to additives such as bio-methane or hydrogen produced from renewable energy. The addition of hydrogen is an opportunity to reduce NOx emissions by increasing the quantity of EGR without affecting the performances of the engine. However, the impact of the addition of hydrogen on knock properties of natural gas is still unknown.

An extensive study of natural gas/hydrogen mixtures autoignition is conducted in the Rapid Compression Machine at the University of Lille. The natural gas is composed of 89% methane, 9% ethane and 2% propane. The effect of temperature, pressure, and mixture composition (pure NG, NG/H_2 80/20, and NG/H_2 40/60) on the ignition delay has been investigated for temperatures between 880 and 1000 K, pressures ranging from 8 and 24 bar and for equivalence ratios of 0.7 and 1.

Hydrogen is found to have an important effect on the reactivity of the mixture in all conditions. The results are compared with previous results on NG ignition from the literature. Simulations made with several thermokinetic models from the literature using the CHEMKIN package are compared with the experimental data.