Alternative Fuels for Future Engines: Investigating the Potential of FACE A, FACE C, and Farnasane as Novel Alternative Gasolines and Biofuels

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World energy consumption is expected to increase 53% by the year 2035, with a continuing dependence on fossil fuels. Therefore, the examination of alternative fossil fuel and biofuel combustion is being researched, utilizing surrogate fuels. This research aims to conduct a novel study determining the potential application of fossil fuels (FACE gasolines A & C) and an alternative biofuel (Farnasane) through measuring the ignition delay of the components formed during their oxidation (2,5-dimethylhexane and 2,3-dimethylbutane) while running comparisons with Primary Reference Fuel (PRF84). Experimentation was conducted using a low-pressure shock tube over the temperature range of 1100 – 1500 K, pressures of 1, 5, and 10 atm, and equivalence ratios of 0.5, 1 and 2 with Argon as the diluent. Ignition delay functions for the basic components were derived through regression analysis: 2,3-dimethylbutane: τ_ign=1.5* 〖10〗^(-6)* P^(-0.6)* X_(O_2)^(-1.67)*exp((20.8* 〖10〗^3)/T) [µsec] 2,5-dimethylhexane: τ_ign=1.23* 〖10〗^(-5)* P^(-0.744)* X_(O_2)^(-1.59)*exp((18.889* 〖10〗^3)/T) [µsec] Based on the results indicating the ability to increase combustion efficiency, a detailed chemical kinetic study was conducted to measure the ignition delay and species time histories of OH, CO, H2O, and CO2 for the targeted fuels. Propitious data was collected on FACE A and FACE C gasolines relatively to PRF84, as there was significant agreement in ignition delay and species formation. All gathered data were compared with previously formulated models, modifying them to increase their accuracy. This all supported the development of chemical kinetics models, paving the way for the development and examination of novel alternative fuels to be applied in future engine efficiency.

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