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A Computational and Experimental Study of Ignition Behavior of Gasoline Surrogate Fuels Under Low-Temperature Combustion Conditions J. HAN, D.C. HAWORTH, Penn State, V.B. KALASKAR, A.L. BOEHMAN, University of Michigan — One strategy for next-generation engines is low-temperature compression ignition of gasoline. Reaction pathways that are not relevant for high-temperature flame propagation are activated under these conditions, and the ignition behavior of these fuels under low-temperature conditions has not been widely explored. Here the ignition behavior of gasoline and two- and three-component surrogates has been studied experimentally and computationally over a range of operating conditions of interest for low-temperature engine combustion. Experiments were performed in a single-cylinder research engine. For each fuel blend, the critical compression ratio (lowest compression ratio at which the main ignition occurs) was determined over a range of operating conditions, by varying one parameter at a time with all other parameters held fixed. A simplified CFD model that considers detailed chemical kinetics was used to simulate the experiment. The focus of the study is to determine which surrogate fuel mixtures and chemical mechanisms are able to capture the ignition behavior of gasoline under these conditions. For example, different ignition behavior is found for different surrogate mixtures that all have the same Research Octane Number, and it is important to capture this behavior in CFD models.

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