Determining the Ignition Characteristics of GCI Blend for Gasoline Compression Ignition Engines Using Chemical Kinetics

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Today, transportation vehicles depend greatly on gasoline and diesel as fuels with their respective engines for mobility. Both engines have negative properties that contribute to leading to dangerous environmental phenomena. Gasoline Compression Ignition (GCI) engines are believed to be promising engines that combine the advantages of gasoline and diesel engines with low emissions and high efficiency. The purpose of my project is to determine the characteristics of a potentially suitable fuel for GCI engines. A custom blend consisting of many components, labeled as GCI blend, is proposed as a candidate fuel for GCI engines. The auto-ignition characteristics of the GCI blend were tested by measuring the Ignition Delay Time (IDT) of the blend in a Shock Tube (ST) and a Rapid Compression Machine (RCM) over a wide range of conditions, temperatures (600-1200 K), pressures (20-40 bar) and equivalence ratios (0.5, 1, 2). Ignition delay was modeled using two surrogates, a two-component surrogate primary reference fuel (PRF80), and a multi-component surrogate fuel (MCS). PRF80 and MCS Experimental results showed a similar pressure and equivalence ratio dependence to the GCI blend. When increasing the pressure and equivalence ratio from 20 to 40 bar and phi=0.5 to phi=2 respectively, the ignition delay of GCI blend was faster than PRF80 and MCS. Experimental and simulated ignition delays show positive agreement at variety of conditions. This research proves that GCI blend is a suitable fuel for GCI engines.

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