



Reducing Emissions and Controlling Combustion Phasing in HCCI Engines

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WARF: P01320US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to effectively control combustion phasing in direct-injection, compression-ignition engines by using suitably timed multiple fuel injections.

OVERVIEW

Direct-injection, compression-ignition engines, also known as HCCI (homogeneous charge compression-ignition) engines, offer an alternative to conventional spark-ignited and diesel combustion systems. HCCI engines produce low particulate (soot) and nitrogen oxide emissions, and exhibit high thermal efficiency.

However, in HCCI engines there is no direct control of ignition, such as a spark. Instead, HCCI engines rely on auto-ignition, making combustion phasing (timing of auto-ignition) difficult to control.

THE INVENTION

UW-Madison researchers have now developed a method to effectively control combustion phasing in direct-injection, compression-ignition engines by using suitably timed multiple fuel injections. In this technique, an initial fuel pulse is injected during the early phase of the compression stroke. The pulse is timed to mix with cylinder air so that it is too “lean” to produce appreciable soot and nitrogen oxides upon combustion, but not so lean that it creates significant amounts of unburned hydrocarbons and carbon monoxide.

Normally, the pulse is also too lean to auto-ignite, leading to problems with combustion phasing. To solve this, the researchers inject a second fuel pulse that provides a locally rich fuel mixture for effective auto-ignition. They have optimized the second injection’s timing and amount to reduce the soot and nitrogen oxides normally resulting from a single, late fuel injection.

THE WARF ADVANTAGE

Since its founding in 1925 as the patenting and licensing organization for the University of Wisconsin-Madison, WARF has been working with business and industry to transform university research into products that benefit society. WARF intellectual property managers and licensing staff members are leaders in the field of university-based technology transfer. They are familiar with the intricacies of patenting, have worked with researchers in relevant disciplines, understand industries and markets, and have negotiated innovative licensing strategies to meet the individual needs of business clients.



APPLICATIONS

- Gasoline engines
- Diesel engines

KEY BENEFITS

- Provides an innovative way for the diesel engine industry to meet tougher, new emissions standards for soot and nitrogen oxides
- Offers a means to control emission levels as well as combustion phasing and engine efficiency in HCCI engines
- Results in engine efficiency comparable to that of diesel engines
- Suitable for two-stroke, four-stroke and rotary HCCI engines, as well as hybrid HCCI/spark-ignited engines
- Researchers have demonstrated effective HCCI phasing control over a wide range of engine speeds and loads
- Produces particulate emission levels similar to those obtained with spark-ignited engines
- Achieves particulate control without the need for expensive and complex particulate traps
- Reduces nitrogen oxides in lean-burn engines without the need for nitrogen oxide catalysts

ADDITIONAL INFORMATION

Related Portfolios

[Reactivity Controlled Compression Ignition Technology Portfolio](#)

Related Technologies

[See WARF reference number P01108US for another technology that reduces soot and nitrogen oxide emissions in diesel engines.](#)

Tech Fields

Engines & Power Electronics - Automotive
Clean Technology - Transportation

CONTACT INFORMATION

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842.

