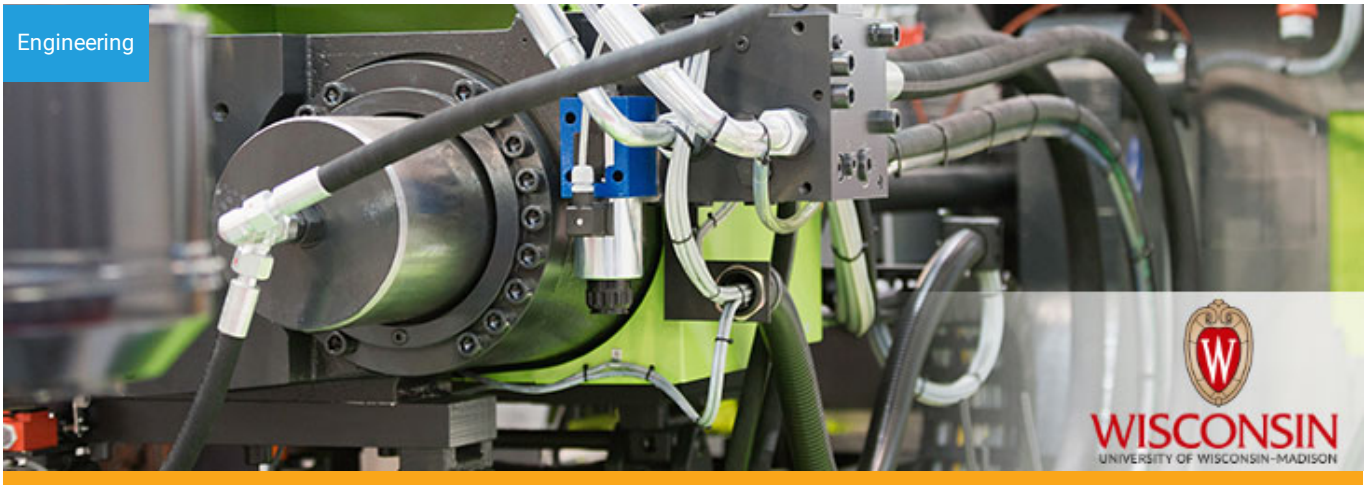
Engineering



Fuel Reactivity Method Cuts Diesel Engine Emissions

View U.S. Patent No. 9,080,501 in PDF format.

WARF: P100054US02

Inventors: Rolf Reitz, Reed Hanson, Derek Splitter, Sage Kokjohn

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a groundbreaking combustion method that has resulted in the most fuel-efficient diesel engine currently known that also is capable of meeting soot and NOx emissions limits.

Overview

Nitrogen oxides (NOx) and soot cause acid rain and smog. They are pollutants that commonly result from the burning of fuel in diesel engines. Engine conditions that reduce NOx emissions tend to increase soot, but reducing soot tends to increase NOx emissions. Due to this "nitrogen oxide-soot tradeoff," reducing both types of emissions at the same time has proven difficult.

One approach is to install "after-treatment" systems that address exhaust after leaving the engine, but these systems can be expensive to install and maintain and can reduce a vehicle's fuel efficiency. The next generation of diesel engines must be efficient while meeting or exceeding emissions standards.

The Invention

UW–Madison researchers have developed a smarter combustion process using in-cylinder fuel blending. The process is called Reactivity Controlled Compression Ignition (RCCI) combustion.

RCCI utilizes at least two fuels of different reactivity and multiple injections to control the timing and duration of combustion. In the process, a low reactivity fuel (e.g., gasoline) is introduced into the cylinder and mixed with air. Then, high reactivity fuel (e.g., diesel) is injected using single or multiple injections. This helps tailor the combustion process for optimal power output at a controlled temperature (to address NOx) and with controlled equivalence ratios (to address soot).

Applications

- Reducing emissions from diesel (compression ignition) engines

Key Benefits

- Unparalleled fuel efficiency
- Reduces NOx by a factor of 100 and soot emissions by a factor of 10
- Reduces heat transfer losses
- Eliminates the need for costly after-treatment systems
- Reduces fuel system cost
- Easily complies with EPA 2010 emissions guidelines without exhaust after-treatment

Stage of Development

Laboratory engine tests achieved 53 percent thermal efficiency (conventional efficiency is about 42 percent) while surpassing government emissions regulations.

Additional Information

For More Information About the Inventors

- Sage Kokjohn

Related Technologies

- See WARF reference number P100054US01 for the researchers' RCCI technology.

Publications

- Splitter D., Wissink M., DelVescovo D. and Reitz R. 2013. RCCI Engine Operation Towards 60% Thermal Efficiency. SAE Technical Paper 2013-01-0279. doi:10.4271/2013-01-0279.
- Read a news story about this technology.

Tech Fields

- Engineering : Engine technologies

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867