

TECHNOLOGY OPPORTUNITY

LASER IGNITION TECHNOLOGY

New laser-based system could improve both natural gas combustion and sensor efficiency

OPPORTUNITY:

This technology uses composite lasers to produce multiple temporal ignition pulses, which can be used to improve the efficiency of both laser ignition systems for natural gas fueled engines as well as laser-induced breakdown spectroscopy (LIBS) sensors. This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

CHALLENGE:

Natural gas-fueled engines help to reduce transportation and energy costs, fuel consumption and harmful emissions compared to conventional gasoline engines. One reason for these improvements is because combustion in a natural gas fueled engine takes place in what is called a lean burn mode, in which fuel is burned with excess of air. However, this lean burn mode may lead to unnecessary misfire when the ignition spark occurs but fails to properly ignite the fuel and air mixture.

OVERVIEW:

Every natural gas-powered engine has a slightly different intake and fuel introduction design, so manufacturers usually limit lean operation to an air/fuel ratio that is closer to what is required to stoichiometrically combust the fuel. This is to prevent misfires from conventional ignition systems but limits the performance improvements and emission reduction potential of the engine. A leaner burning engine results in cooler combustion and fewer nitrogen oxide (NOx) emissions.

NETL researchers have developed a laser ignition system that uses a single laser to produce two distinct types of output pulses, both pulsed and continuous wave (CW) output simultaneously, that are focused into the combustion chamber, providing a longer lasting spark plasma that significantly increases the chances of initiating proper ignition for lean operation.

This same technology can also be used to improve the sensing efficiency of LIBS systems, as it can be used as an ignition source for solids, liquids or gases. It may also be used as a plasma excitation source for LIBS. As part of a LIBS excitation laser system, the technology could initiate and maintain a plasma for an extended period, improving the signal-to-noise of a LIBS system.

This NETL technology offers several advantages over conventional technologies for both natural gas fueled combustion and LIBS sensing.



(continued)



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ADVANTAGES:

- Helps prevent misfires in natural gas fuel engines
- Allows leaner mixtures of air and fuel to be used
- Improves efficiency of natural gas fueled engines
- Reduces harmful emissions
- Improves signal-to-noise of a LIBS system

APPLICATIONS:

- Natural Gas fueled transportation
- LIBS sensing systems

PATENT STATUS:

- U.S. Non-Provisional Patent Application No. 16/011,846
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