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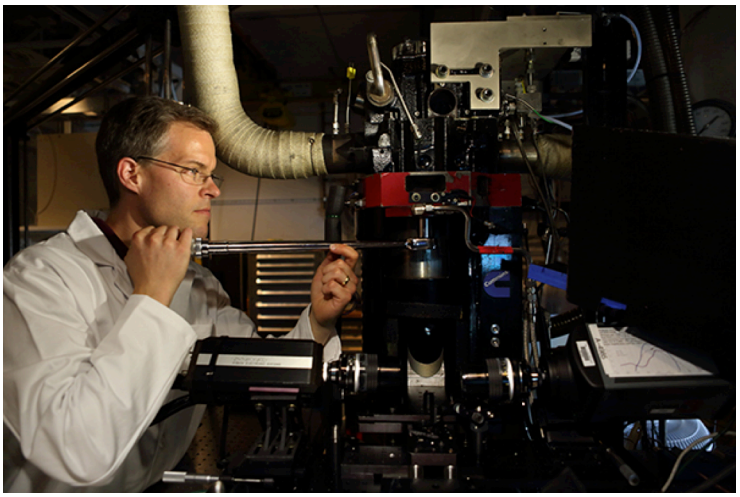
Low-Temperature Combustion Enables Cleaner, More Efficient Engines

Combustion Research Facility researchers Mark Musculus, Paul Miles, and Lyle Pickett (all in the Engine Combustion Dept.), communicate the details of how low-temperature combustion (LTC) works to the broader engine research community in their paper, "Conceptual models for partially premixed low-temperature diesel combustion," in *Progress in Energy and Combustion Science*. This research and data provides a necessary science base for auto and engine manufacturers to build the next generation of cleaner, more fuel-efficient engines using LTC.



Using new optical-diagnostic techniques, Sandia combustion researcher Mark Musculus and his colleagues identified the sources of key pollutants from LTC engines. Understanding how LTC works as a combustion technique may lead to broader use of cleaner diesel engines. (Photo by Dino Vournas)

While LTC helps reduce particulate matter and nitrous oxides pollution, it isn't without its own problems. Carbon monoxide (CO) and unburned hydrocarbons (UHC) pollutants increase. Both are not only toxic, but also reduce fuel efficiency. Using new optical diagnostic techniques, the CRF research team identified these LTC engine emission sources. In a breakthrough measurement, researchers used two-photon laser-induced fluorescence to map in-cylinder CO, a difficult measurement that had never been achieved inside a diesel engine.

With this new understanding of UHC and CO emissions, Musculus and Sandia post-doctoral researcher Jacqueline O'Connor found that adding post-injections (smaller squirts of fuel after the main spray in just the right areas) extends the complete combustion zone over a larger region—leading to lower UHC and CO emissions while increasing engine efficiency. The increased efficiency also translates into lower CO_2 emissions.

The Sandia work was completed for DOE-EERE.

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