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Enabling Alternative Fuel Combustion in Diesel Engines

Improved Thermal Efficiency and Reduced Emissions

A compact thermally integrated reformer design partially converts alternative fuels to reformate, a gaseous mixture of hydrogen, partially reacted products and some original fuel. This mixture extends the possible diesel engine range of operation with low reactivity fuels like ammonia and increases thermal efficiency through recovering wasted heat from the exhaust. Fumigating hydrogen-rich reformate into the air intake allows more stable dilute low temperature combustion in the engine thus reducing NOx and particulate emissions.

Fuel Reforming Alternative to Traditional Diesel Dual-Fuel

Diesel engines make up a multi-billion dollar market worldwide and are used in both on-road vehicles and off-highway applications. They offer high torque and excellent reliability; thus, they are unlikely to be replaced within the next half century for high power applications. Improving emissions and reducing diesel fuel costs are long held industry goals. Switching to alternative fuels in can enable emissions reductions, increase environmental sustainability, and reduce fuel costs. Some alternative fuels like ammonia and hydrous ethanol are attractive renewable fuels for diesel engine use but need to be used in combination with diesel due to their low reactivity (i.e., they do not readily ignite in diesel engines). Fumigation introduces the alternative fuel into the air intake of the engine and retains the directly injected fuel to act as the ignition source. For aftermarket applications, current fumigation systems result in significant emissions of unburned fumigated fuel, are limited to very low diesel fuel replacement levels and do not significantly reduce emissions like nitrogen oxides (NOx). Partially reforming low reactivity fuels enables high replacement levels and reduces emissions of both the fumigated fuel and regulated pollutants.

BENEFITS AND FEATURES:

- Enables fuels like hydrous ethanol, anhydrous ammonia, natural gas to be used in diesel engines at high replacement levels
- Reduces engine fuel consumption
- Allows flexible ratios of diesel and alternative fuels to be used in diesel engines
- Catalytic heat exchanger configured in exhaust manifold provides both thermochemical recuperation and reforming capabilities

APPLICATIONS:

- Light, medium and heavy duty diesel engine applications
- Aftermarket and OEM

Phase of Development - Prototype. Two reactors will be tested (Fall 2017), and ammonia and hydrous ethanol will later be tested in an extensive experimental campaign.

Researchers

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Category

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