Internal Combustion Engine Efficiency with Methanol Reforming and Direct Injection of Methanol Fuel  
Technology #12864

Applications

Reformer enhanced direct injection methanol engines improve efficiency over traditional combustion engines by carefully injecting ethanol directly into the cylinders. The ethanol is injected at high-loads (i.e. when climbing up a hill) and can be used in conventional gasoline engine applications.

Problem Addressed

A very high efficiency spark ignition engine can be made possible by the combination of two modes of operation: Ultra dilute operation at low loads and highly turbocharged, high compression ratio operation at high loads increases the overall efficiency. Conventional gasoline engines are naturally aspirated - rely only on atmospheric pressure for air intake - and port fueled - fuel is sprayed into the intake ports directly into the engine cylinder. This technology increases efficiency by more than 40% over conventional gasoline engines by using direct injection and methanol reforming.

Technology

This supercharged and turbocharged spark-ignition engine combines a methanol reforming system with the direct injection of methanol fuel to extend the efficiency of internal combustion engines to more than 40% over conventional gas engines, and to more than 10% over clean diesel and typical gasoline/electric hybrid vehicles. This methanol-fueled engine system uses direct injection during high-load operation and, during low-load operation, sends a fraction of the fuel to an in-engine methanol reformer to generate a hydrogen-rich gas that improves combustion stability by speeding up the combustion process. Such increased efficiency at both load-ends of engine operation can enable engine downsizing. Reforming the methanol also reduces vehicle emissions to very low levels with lean or heavy exhaust gas recirculation (EGR) operation at low loads. This methanol-reforming/direct-injection engine could be employed with other fuels in addition to or instead of methanol, including gasoline, ethanol and natural gas.

Advantages

- Increases engine efficiency
- Suppresses pollutant emissions
- Enables engine downsizing
Categories For This Invention:

Energy  
Hydrocarbons  
Diesel Engines  
Transportation  
Engines/Motors

Intellectual Property:

Fuel management system for very high efficiency flex fuel engines powered by methanol and gasoline  
Issued US Patent  
8,677,949  
Reformer enhanced alcohol engine  
Issued US Patent  
9,353,678

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Publications:

MIT's Pint-Sized Car Engine Promises High Efficiency, Low Cost  
MIT News  
October 25, 2006

External Links:

Plasma Science and Fusion Center, MIT  
https://www.psfc.mit.edu/

Image Gallery: