UNIVERSITY OF BIRMINGHAM

Future Engines & Fuels Laboratory

investing in your future
European Regional Development Fund
European Union

Advantage West Midlands
www.advantagewm.co.uk

JAGUAR

LAND ROVER

F. Zhang, Prof. H. M. Xu

Dieseline Fuelled Partially Premixed Compression Ignition

Challenge

➢ European emission standard is more and more stringent, and ultra clean diesel engine technology needs to be introduced quite urgently.

➢ The efficiency of SI engines is far lower than CI engines, and gasoline type of fuels need to be more efficiently used with the limit of energy resource.

Solution

➢One potential way to solve the problem is introducing gasoline into diesel engines.

▪ Blending gasoline with diesel gives the fuel higher volatility and higher ignition-delay, which helps to increase the premixed combustion and reduce emissions dramatically.

▪Gasoline can be more efficiently used in CI engines compared to SI engines (the CI engine owns high compression ratio and less pump loss).

▪ The blending ratio and the Injection strategies need to be investigated .(advance injection, split injection, cooled EGR).

Test Cell

➢ Ford Dual Torque Puma engine,2.2 litre

Figure 1 Ford Puma engine test rig

Bore	86 mm
Stroke	94.6 mm
Compression Ratio	16.6
Engine Capacity	2198 cc
Max Power	96 KW (±5%)@3500 rpm
Max Torque	310.0 NM(±5%)@1600-2500 rpm
Injector type	Common Rail, Direct Injection

Table 1 Puma engine specification

➢ The emission measurement

Figure 2 Horiba-MEXA 7100DEGR

Figure 3 SMPS from TSI

Figure 4 CLD 500 Fast NOx

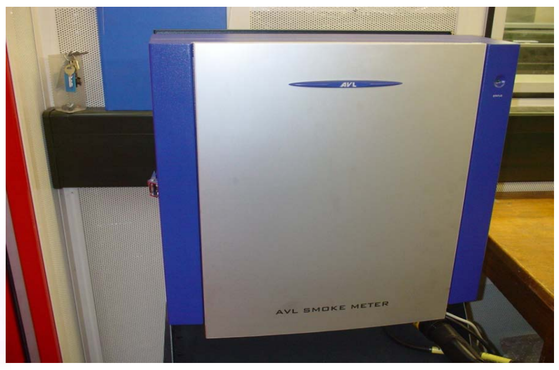

Figure 5 AVL 415S Smoke Meter

Results & Discussion

The test is with three different fuels: standard diesel, 30% gasoline in diesel and 50% gasoline in diesel by volume. Appropriate lubricant is added to the blend fuel. The injection timing is adjusted for different fuels to maintain the same combustion phase.

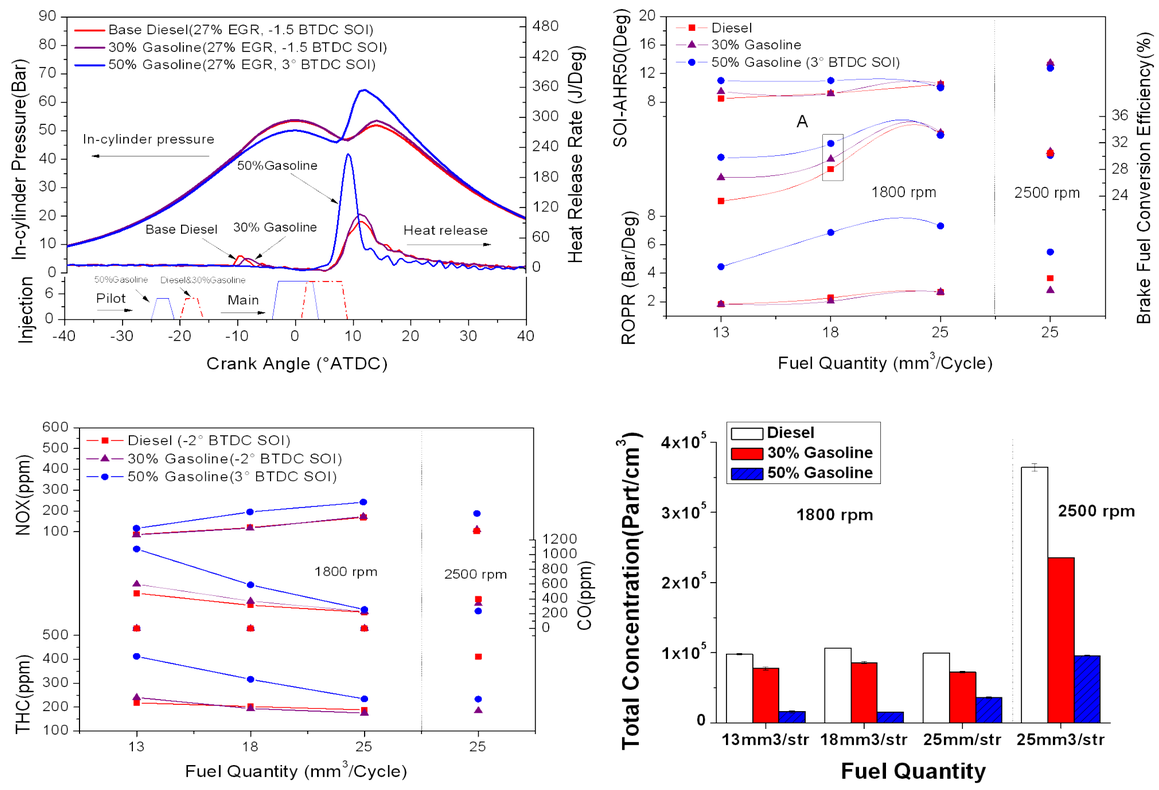

Figure 6 Combustion and engine out emission of standard Diesel, blend fuel G30 & G50

Conclusions can be made from the results so far:

➢The fuel conversion efficiency of blend fuel is similar to neat diesel, that means the gasoline can be more efficiently used in the CI engine than the SI engine by blending it with diesel.

➢Particulate total concentration can be reduced dramatically by blending gasoline with diesel.

Future Work

More work would focus on the on-line in-cylinder blending of diesel and gasoline, in which case the blending ratio can be easily changed to obtain good performance and low emissions at different engine condition points. A general sketch map of the single cylinder dual-fuel system is shown below.

Figure 7 Single cylinder dual-fuel system

Publications

1. Fan Zhang, Hongming Xu, Jun Zhang, Guohong Tian, GauTam Kalghat ‘ Investigation into Light Duty Dieseline fuelled Partially-Premixed Compression Ignition Engine’, SAE 2011-01-1411.
2. Jun Zhang, Fan Zhang, Guohong Tian, Hongming Xu, Yanfei Li, Ritchie Daniel, Haiwen Song, Phil Price’ The Particle Emission Characteristics of a Light-Duty Diesel Engine by Using Different Pilot Injections’, SAE 2010-01-1959.
3. Jun Zhang, Guohong Tian, Hongming Xu, Fan Zhang, Ritchie Daniel.’ The Application of Two Closely Coupled DPFs as the After-treatment System’. SAE 2010-01-1939.
4. Jun Zhang, Hongming Xu, Guohong Tian, Fan Zhang, M.L.Wyszynski, Phil Price.’ The Particle Emissions Characteristics of a Light-Duty Diesel Engine With 10% Alternative Fuel Blends’. SAE 2010-01-1566