AUTOMOTIVE

Car emissions are an issue of reform

Catalyst-based reformer could contribute to emissions reduction

HELEN KNIGHT REPORTS

An on-board reformer capable of converting exhaust gas into fuel and removing pollutants could help carmakers to achieve tough emissions targets.

The fuel efficiency of modern cars has improved by 20 per cent since 2010, as a result of improvements to engine design, weight reductions, and the use of hybrid technologies.

But while these improvements have enabled manufacturers to meet their 2015 targets for reducing carbon-dioxide emissions, car makers are still 15 to 30 per cent short of their 2020-21 target of 95g per km, according to Dr Athanasios Tsolakis at Birmingham University.

> "It produces a hydrogen-rich gas for combustion in the engine"
>
> Dr Athanasios Tsolakis

To help meet this target, Tsolakis and his colleagues are developing a catalyst-based reformer capable of improving the fuel economy and therefore reducing greenhouse gas emissions of petrol engines.

"The system uses the engine exhaust gas, consisting of heat, water, CO_2 and in some cases O_2, and fuel to produce a hydrogen-rich gas that is then used for combustion in the engine," he said.

The EPSRC-funded project, which also includes researchers at Brunel University, as well as Ford and Johnson Matthey, will use platinum/rhodium (Pt-Rh)-based catalysts to produce the hydrogen-rich gas, which can then be used for combustion.

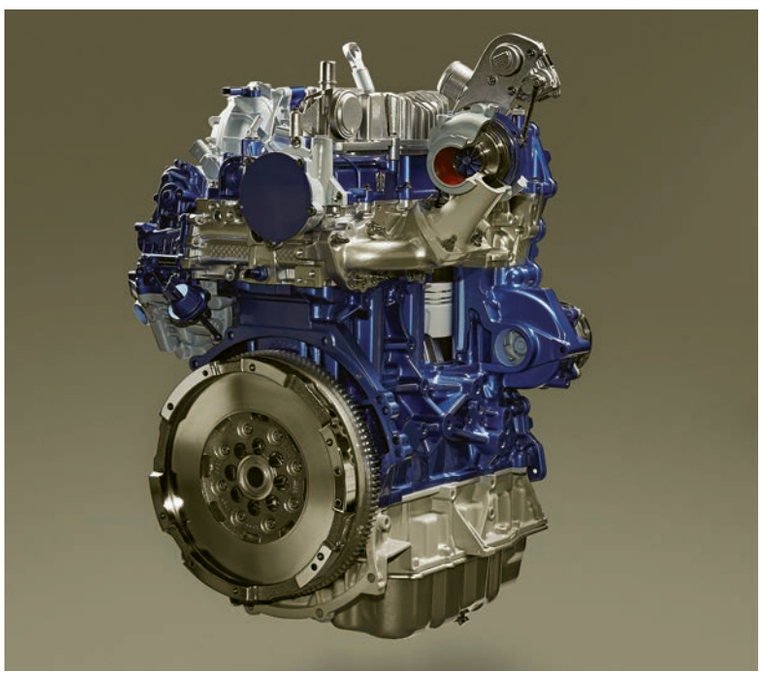
"This means that the engine fuel – gasoline and hydrogen-rich gas – has a higher energy content," he said.

It should also reduce engine pumping losses by allowing for a better throttle position, said Tsolakis.

The technology can also be designed to reduce emissions from diesel engines, he said. It can also indirectly improve diesel engine fuel efficiency by improving the performance of after-treatment systems. Existing after-treatment systems can use large quantities of fuel to remove pollutants from the exhaust, but the new reformer would need only a few parts per million of hydrogen to operate, said Tsolakis.

In the first stage of the project, the fuel reformer will be integrated into the exhaust, to provide small quantities of hydrogen-rich gas to the engine's after-treatment system, when needed.

The researchers plan to develop a compact catalyst brick, designed using additive manufacturing techniques, which can be integrated into the after-treatment system in both diesel and lean combustion petrol engines.



The fuel efficiency of modern cars has improved by 20 per cent since 2010

MARINE

Remote-controlled manoeuvres

Vessel demonstrated in Copenhagen harbour

The world's first remotely operated commercial vessel has been demonstrated by Rolls-Royce and towage operator Svitzer in Copenhagen harbour.

Svitzer's 28m-long Svitzer Hermod undertook a number of remotely controlled manoeuvres earlier in 2017. From the quayside in Copenhagen harbour the vessel's captain, stationed at its remote base at Svitzer headquarters, berthed the vessel alongside the quay, undocked, turned 360°, and piloted it to the Svitzer headquarters, before docking again.

The companies will continue to test remote and autonomous operations for vessels with primary systems made up of autonomous navigation, situational awareness, remote-control centre and communication.

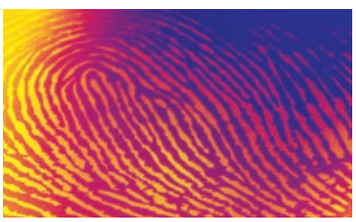
Built to a Robert Allan ship design, the Svitzer Hermod is equipped with a Rolls-Royce Dynamic Positioning System. **JF**

SECURITY

Infrared eyes at the scene of the crime

Method could help to embellish fingerprints

STUART NATHAN REPORTS



The ablation can vapourise water

Fingerprints can identify people present at a crime scene, but these marks can hold more information than just the identity of the person who made them.

Residues of any substances the person had been in contact with can also be transferred to surfaces they touch – but recovering and identifying those substances can be very difficult.

Researchers from Louisiana State University in Baton Rouge have now devised a method that could help with this problem.

Inspired by team member Eden Camp's time interring with the Louisiana State Police Crime Lab, Prof Kermit Murray and postdoctorate student Fabrizio Donnarumma applied their expertise in using infrared lasers to lift minute layers of tissues for bioanalysis to the problem.

In a paper in the *Journal of The American Society of Mass Spectrometry*, Murray's team describes how it found it could use its laser equipment to ablate away fingermarks from a surface, suck the resulting vapour into a thimble-sized filter system and then subject these captured materials to techniques such as gas chromatography or mass spectroscopy to identify what substances were present.

The ablation works by rapidly and specifically vapourising any water in the fingermark, carrying any other trapped material off the surface.

"We realised that if our techniques work for biomolecules as fragile as DNA and RNA, it should work with almost anything," said Donnarumma. "We can capture almost anything that is on a surface. In this case, it just happened to be fingermarks."