Path to greener mobility

Hydrogen fuel cell technology is set to play an important role in the development of a new generation of electric and hybrid vehicles

Global environmental protection initiatives require a drastic reduction of greenhouse gas emissions. Hydrogen is considered one of the most promising energy carriers of the future. Green hydrogen is not only CO_2-free and used in fuel cell vehicles, but also has great potential for use in internal combustion engines. The automotive industry is working on different zero emission concepts to meet upcoming decarbonization targets. As an innovation leader in the automotive industry, AVL contributes its many years of experience in engineering, simulation and testing of ICE and fuel cell technologies.

The measurement of hydrogen emissions is essential for both fuel cell and ICE applications. For example, the latest draft of the EPA 40 CFR Part 1065 regulation stipulates zero carbon fuels and demands the measurement of components such as hydrogen (H_2) and water (H_2O) to calculate the chemical balance. AVL offers a mass spectrometer-based analyzer, the AVL H2D, that enables fast H_2 measurement with a response time within 200ms. For development purposes, a high signal resolution is required. The mass spectrometer therefore supports, like other analyzers used in emissions testing, a 10Hz data rate. AVL's DNA not only comprises engine emission testing but also the provision of suitable test facilities for upgrading or redesigning the conventional test cell environment to successfully validate hydrogen engines at every stage of development. The operation of hydrogen combustion engines or fuel cells on testbeds requires adaptations to the test facility infrastructure and equipment. Ensuring a safe testbed is a top priority.

When it comes to fuel cell development and testing, anode measurements are useful in addition to cathode or tailpipe exhaust gas analysis. AVL offers a specific version of the H2D for non-intrusive fuel cell testing with a second low flow rate inlet. The anode inlet is specially designed for this measurement task as the gases are supplied to the fuel cell with high pressure and a low gas consumption is required.

To ensure proper operation of the fuel cell or the hydrogen-fueled engine, the AVL H2D is available as an extra version, badged the AVL H2D+, that can analyze further components of interest including N_2, O_2, H_2O and CO_2.

ABOVE: A fuel cell passenger car that efficiently generates electricity from hydrogen fuels with no emissions

RIGHT: AVL's H2D+ mass spectrometer for analyzing hydrogen emissions

In the test cell, the H2D unit can be seamlessly connected to an AVL emission measurement system such as an AMA SL, AMA i60 or Sesam i60 FT, and is controlled by one common interface to the automation system.

The emission automation system AVL iGem 2 for vehicle testing provides legislation-compliant testing operations for fuel cell vehicles on a chassis dyno. The iGem 2 enables pure fuel cell testing on the testbed or mixed operation with an ICE. To determine H_2 consumption of fuel cell vehicles, both the gravimetric and the fuel flow method are supported. Theoretical range calculation for FC vehicles along with energy flow measurement is executed and displayed in the final test report.

AVL is well prepared to holistically support the upcoming challenges related to the development and testing of hydrogen technology. To support the industrial breakthrough of hydrogen and make fuel cell technologies efficient, durable and affordable,

AVL has established its own hydrogen and fuel cell test center. The state-of-the-art testbeds and development environments are set for the high-performance applications of the future. ❮

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