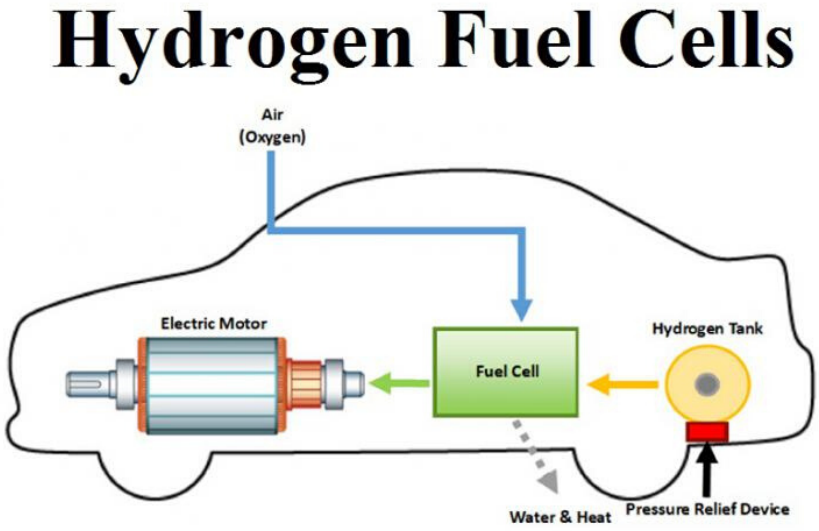
APPLICATION NOTE N.0620-3

HYDROGEN FUEL CELL TESTING

ETG 9500 FTIR with advanced chemometric analysis in order to identify and quantify the gases in the H2 stream.

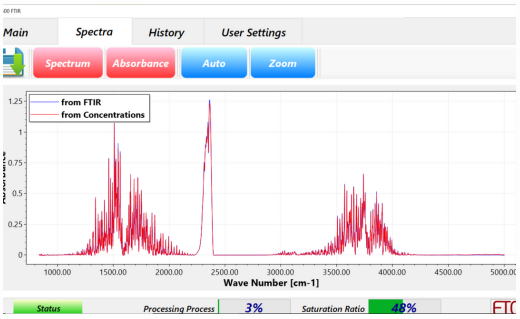


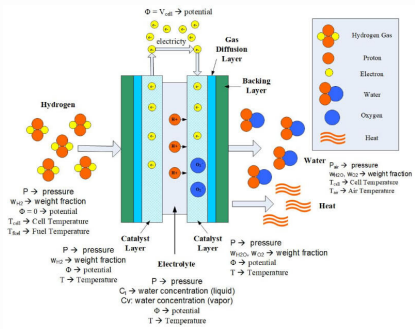
As the alternatives to fossil fuels for power generation and automotive power become more widespread and preferred, so has increased the research and testing of hydrogen gas in fuel cells. The hydrogen (H2) gas used in fuel cell has to be free of impurities in order to make the fuel cell as efficient as possible and so quality thresholds have been set in legislation.

Such legislation as SAE J2719 provides hydrogen fuel quality standards for proton exchange membrane (PEM) fuel cell vehicles. If impurities above these thresholds are present in the H2 fuel then there is a risk of not only making the cell inefficient, but also unrecoverable back to its peak operating voltage as the fuel cell electrode becomes poisoned.

FTIR ETG 9500 DETECT HYDROGEN IMPURITIES

Method ASTM D7653-10 Determination of Trace Gaseous Contaminants in Hydrogen Fuel by Fourier Transform Infrared (FTIR) Spectroscopy is a standard that describes the use of FTIR to measure the impurities in the H2 fuel. ETG can deliver FTIR analyser specifically designed to meet the requirement of this test method. FTIR is ideally suited to measurement of the multiple gas components required in H2 fuel testing, such as ammonia, carbon monoxide, carbon dioxide, formaldehyde, formic acid, methane, ethane, ethylene, propane and water. ETG's analysers can be designed to be deployed in the field, such as analysing hydrogen fuel at the point of user at a fuelling station and in H2storage vessels, or can be installed at the hydrogen production facilities of the bulk gas manufacturers.





Sources of Impurities
Carbon Monoxide in H2 - CO Effect on Fuel Cell
Ammonia in H2 -NH3 Effects on Fuel Cell

FTIR For H2 Impurity Analysis

Real-time analysis at ppb levels
FTIR advantage
Multiple components analysis with one unit
Single analyzer for all the impurities except O2, H2, Ar, N2
High resolution enables speciation between similar molecules Butane, Propane, Ethane, Methane, fuel sources, etc.
Permanent calibration
Analysis performed at various sites
H2 production site
H2 storage site: gas or liquid cylinders
At - Line analysis at fueling station

Hydrogen is a clean fuel that is being increasingly used in both transportation and power generation applications. Additionally, hydrogen is being explored as a means to decarbonize industrial processes that have struggled to reduce greenhouse gas emissions, including chemical production, hydrogen as a heating source, and iron and steel production

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