PROCESS TRACE MOISTURE ANALYZER FOR HYDROGEN METERING AND GAS GRID INFEED PLANTS

The conversion of electric power from renewable sources to Hydrogen is another key technology to decarbonization and seasonal energy storage.

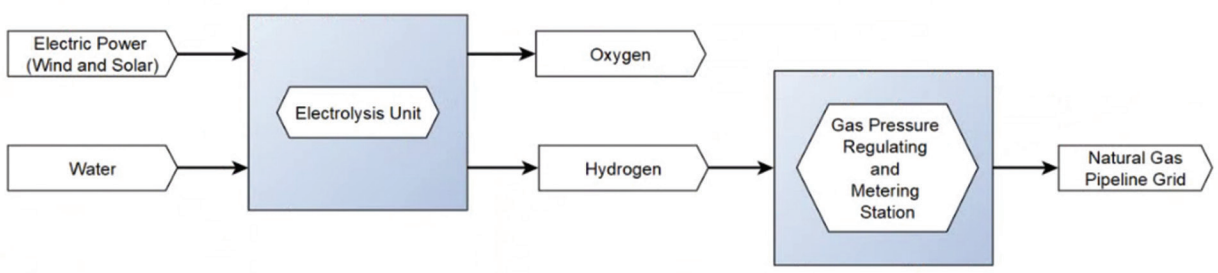

Figure 1: Simplified schematic of a Hydrogen production, metering and infeed plant based on electrolysis

Reliable moisture measurement to comply contracted limitsand ensure safety

Polymer Electrolyte Water Electrolysis (PEM) or Alkaline Water Electrolysis areenhanced principles fordecomposing Water to Hydrogen and Oxygen by use of electric current. Electric power from renewable sources like wind or solar power is usually not congruent to the actual demand of electricity. The conversion of electric power to Hydrogen makes is storable and capable to be transported at the existing gas pipeline grid, where it can be re-electrifiedwhen required or used as fuel for cars or other industrial processes. Nowadays the common low-temperature principles are PEM and Alkaline type electrolysis unitswhere the interchange of atoms and ions by removal or addition of electrons from external power source takes place. Usually several cells are combined to stacks for the production of very pure and dry Hydrogen which is also already pressurized. At the gas pressure regulating and metering station the Hydrogen is analyzed on traces of Oxygenand Nitrogen, flow rate and heating value. The analysis of trace humidity is of particular importance when additional gas compression is needed to feed the gas to the natural gas pipeline grid. Contracted feed-in limits (e.g. 50 mg/m³ Moisture) are important to prevent condensation in pipeline which lead to operational problems (corrosion and erosion) and safety risk (water slugs and even blockage by hydrate formation).

Figure 2: Sensor installed in sensor retraction tool

A suitable moisture analyzer for this application is hallmarked byitsreliability,especially in cases where the plant is operating to load-follow thedemand of Hydrogen. The BARTEC Benke's trace moisture sensors are trimmed to superior robustness andeven (unwanted and unexpected) water slugs does not damage the sensor. On request the reliability of the sensor calibration is assured and tested by an independent and accredited laboratory on request.

Most of the plants are small sized and unmanned or are even locatedat offshore platforms. A regular sensor exchange or extensive maintenance must be avoided to keep the operational cost as low as possible. And in case of yearly check, the installation of the sensor with a sensor retraction armature makes maintenance easy, quick and without process interruption.

The HYGROPHIL F is designed for the needs of the natural gas industry

The core element of the moisture sensor is an optical thin film element made of silicon dioxide and zirconium dioxide. The microporous stack of alternating high and low refracting optical layers is forming a Fabry-Pérot Interferometer with a distinctive and reliably detectable reflection minimum in the spectral range around 820 nm. Selective to water, molecules can diffuse into the porous Fabry-Pérot element, which then performs a shift of the reflection minimum in proportion to the actual water vapour pressure. The spectral shift is detected and evaluated with a compact high-resolution polychromator, which is located in the evaluation unit together with the light emitting diode. The interconnecting fiberoptic cable can be up to 800 m long because of the detection of an optical minimum instead of an intensity change. The evaluation unit processes and calculates the present dew point temperature as well as other units such aswater vapour pressure, parts per million, mg/m³ and further more. It offers the indication of the dew point temperature at current line pressure as well as to different defined reference pressure. Optionally the calculation from dew point temperature to mg/m³ can be done in conformity to DIN EN ISO 18453, which takes respectof the entered gas composition.

Several analog outputs, MODBUS, PROFIBUS RTU and via TCP/IP as well as relay contacts are equipped as standard for interconnection to the control system.

Thousands of installations worldwide prove the advantages of this measurement principle:

- Robust sensor construction for outstanding long-term stability (ideal for offshore applications)
- Sensor validation in Hydrogen by accredited and independent laboratory available
- Easy sensor cleaning and almost no maintenance required
- In-line installation with sensor retraction armature possible (fast response and emission-free)
- Flexible on-line solutions with customized sample conditioning systems
- Certified for safe operation in hazardous area (ATEX, IECEx, CSA, TR CU)

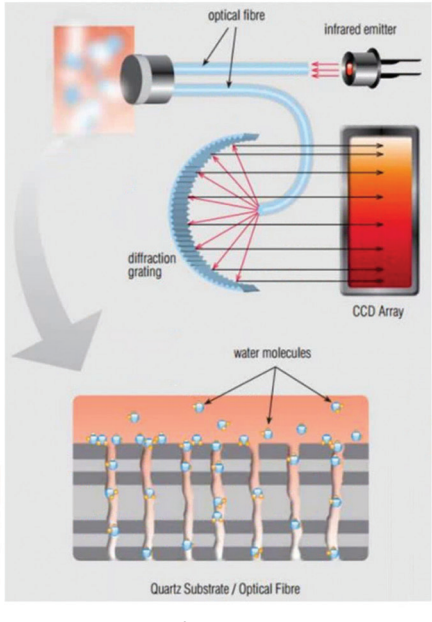

Figure 3: Schematic of the Measurement Principle

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