MEASURING HYDROGEN PURITY

The product provides reliable, stable instrumentation for real-time H2 fraction determination

The production and use of hydrogen is expected to increase dramatically in the coming years as the search for low-carbon alternatives to fossil fuels gathers pace. Hydrogen can be produced from renewable energy and water and does not produce CO_2 on combustion, but its properties vary significantly enough from those of natural gas such that it forces new considerations on measurement technology.

There are many different norms for hydrogen quality and at least as many requirements from end-users that must be respected.. These can range from ultra-pure hydrogen for hydrogen fuel cells (from e.g. 99.97%, ISO 14687-2), to combustion applications, where lower qualities (<98%) can easily suffice.

To ensure that purity requirements are met, hydrogen quality is measured during production, transport and before end-use. For the most stringent requirements, the hydrogen fraction as well as the fractions of all impurities must be determined. In this case the individual gas components must be measured directly, for example using a gas chromatograph.

For less exacting measurement tasks, such as the determination of hydrogen purities on the order of 98% or even 99.5%, or as an online monitor of hydrogen purity and gas quality, correlative measuring technologies can be an excellent alternative. Correlative measurements function by equating the measured quantity (e.g. thermal conductivity) to, for example, the hydrogen fraction via calibration. Measuring instruments based on these technologies are significantly less expensive (CAPEX and OPEX), require less maintenance, are more robust and can easily be distributed and integrated into an existing infrastructure.

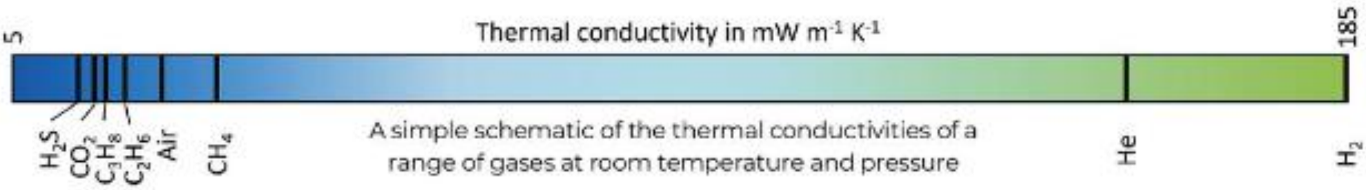
The physical properties of hydrogen are very different to virtually every other gas, which makes correlative measuring instruments particularly useful for hydrogen purity applications. Such instruments are typically based on measurements of thermal conductivity, speed of sound, or density of the gas mixture. Measuring instruments based on thermal conductivity, such as the gasQS static from Mems AG, can easily be configured to measure thermal conductivity in the range of interest, regardless of whether this is 99.5-100%, 98-100% or even 0-2% hydrogen. It is also precise, with excellent long-term stability, and is temperature (-20°C...+80°C) and pressure compensated (0barg...15barg).

One property of correlative measuring instruments with a single measurand is the requirement that the measured gas mixture must be quasi-binary and set at calibration, otherwise small errors in the measurements can result. However, for hydrogen purity applications these errors are reduced considerably; the thermal conductivity of hydrogen is so much higher than that of other gases (other than helium) that changing the ratio of impurities does not significantly impact the thermal conductivity of the gas mixture and hence the measurement accuracy.

The gasQS static from Mems AG is an example of a correlative measuring instrument based on thermal conductivity measurements

The measurement challenges linked to the advancing hydrogen economy are many and varied, with no one-size-fits-all solution. Correlative measuring instruments are characterised by simplicity, cost-effectiveness and robustness and have the potential to play a significant role in hydrogen purity measuring solutions. •

For more information visit: www.mems.ch



A simple schematic of the thermal conductivities of a range of gases at room temperature and pressure