An introduction to...

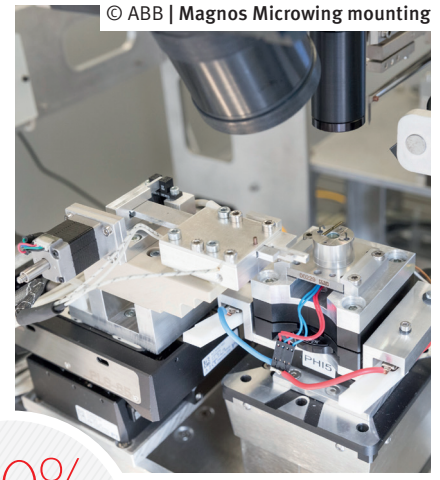
Digital oxygen measurement

Experts at the Swiss instrumentation and process automation expert ABB are breathing new life into an established technology to measure the most traditional of all industrial gases: oxygen.

The oxygen molecule has mystical magnetic properties which allow it to be measured using the paramagnetic technique, which has traditionally relied on a dumbbell with two glass spheres that contain nitrogen, which is suspended on a fine wire. The sample is passed over the dumbbell which is in a strong magnetic field. Oxygen in the sample gas mixture causes the dumbbell to rotate and the rotational torque can be measured to determine the amount of oxygen in the sample.

Despite decades of incremental product development, some paramagnetic oxygen analyser designs have suffered from a small, but noticeable drift, which led to the requirement for frequent calibration. A recent innovation from ABB has put that problem completely in to the rear-view mirror! Its Magnos28 analyser replaces the traditional nitrogen gas-filled dumbbell with a solid state electronic microwing: digitalisation, in its most fundamental form. The microwing sensor reacts very quickly and accurately to oxygen concentration changes due to its very low mass, high width-to-thickness ratio and optimised magnetic field distribution. Furthermore, the influence of moisture is drastically reduced with this patent-pending technology.

Micheal Moede, Product Manager at ABB Automation in Frankfurt, Germany picks up the story. "One of the challenges for oxygen analysis in air separation unit operations is measurement of the final product. When we developed the Magnos28 microwing paramagnetic oxygen analyser one of our ideas was to apply the instrument in advanced air separation unit process control strategies. We can manufacture the instrument with various measurement ranges and of high relevance to industrial gases production is the 98 to 100% range. Imagine that we have compressed all the data that would normally be gathered in a 0 to 100% measurement range and crammed it into that tiny 2% band between 98% and 100%... that's how ultra-sensitive the Magnos28 instrument can be."



© ABB | **Magnos Microwing mounting**

100%

Data is crammed it into a tiny 2% band between 98% and 100% range

The benefits of accurate final oxygen product measurement are realised on the ASU with reduced power consumption. Measurement of oxygen with high repeatability and accuracy means that the ASU can be run close to the optimum point with minimal risk. Furthermore, the very low drift on the instrument also reduces the required calibration frequency which minimises the required man hours and labour cost for periodic calibration and testing.

Flying colours for the microwing in recent field test

AlzChem, located in Bavaria, is an innovative manufacturer of specialty chemicals. The site uses different air gases for a range of production operations. These are produced on its own captive ASU. The operating costs associated with its ASU are primarily related to the cost of electrical power. This cost can be burdensome to site efficiency targets if process variables on the ASU are not closely scrutinised. Gas analysers are used throughout the ASU to ensure the efficient use of power and guarantee product quality.

To measure pure oxygen final product concentrations on the ASU, in the range of 99.9-99.95%, AlzChem has been using paramagnetic oxygen analysers for many years. In a recent field trial, it tested the Magnos28 oxygen sensor in parallel with its established device. Over a period of several weeks, the results of this field test showed that the Magnos28 provided better performance in terms of improved accuracy, tighter repeatability and reduced drift.

Jürgen Wimmer, responsible for plant inspection at AlzChem, comments on his satisfaction with the results of the field trial, "We always work on continuous improvement to get the best-in-class manufacturing processes for our innovative products. The Magnos28 oxygen analyser uses the latest technology with its unique design and manufacturing process. Therefore, it was a natural choice for us to test the Magnos28 in our air separation unit."

"We established that the oxygen measurement from the Magnos28 is more accurate, more precise and within tighter tolerances compared to the instrument that was previously in use. We are convinced of the improved repeatability and stability of the measurement and confident that this will lead to reduced power consumption and reduced calibration related operating costs on our site."

ABOUT THE AUTHOR

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