Fuji Electric

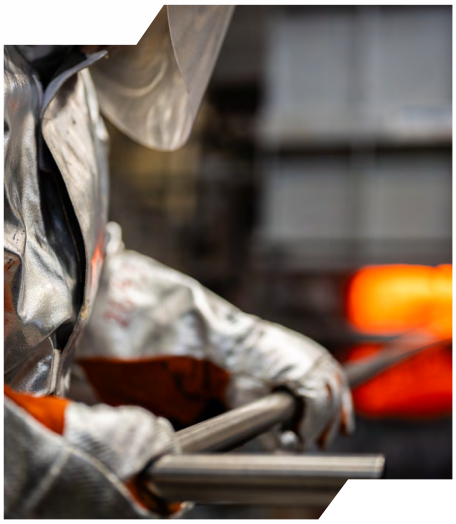
Innovating Energy Technology

How can reliable hydrogen measurement be ensured in a heat treatment furnace?

Metallurgy

Keywords

- Hydrogen
- Heat treatment
- Controlled atmosphere
- Industrial safety



Controlled atmosphere heat treatment furnaces are essential in metallurgy for processes such as annealing, quenching, and brazing. Their atmosphere consists of a mixture of hydrogen (H_2) and nitrogen (N_2): hydrogen acts as a reducing gas, eliminating oxides and improving the brightness of the parts, while nitrogen, which is inert and economical, is used to purge and dilute the hydrogen to reduce the risk of explosion.

For example, a cycle may start at 100% H_2 and then be gradually diluted to 10%, with nitrogen contributing to the stability and safety of the process.

In this context, measuring hydrogen concentration becomes a critical parameter: it determines the quality of the treatment, the safety of operators, and regulatory compliance. European regulation NF EN 746-3 requires strict control of combustible atmospheres and purge devices before any introduction of hydrogen. The industries concerned must therefore guarantee the traceability and safety of their processes with suitable and qualified instruments.

Measurement conditions and accuracy requirements for hydrogen measurement in heat treatment

It is necessary to be able to measure hydrogen concentration in an extremely demanding environment.

The heat treatment furnace operates at temperatures that can exceed 1000°C, and the atmosphere is dusty and subject to pressure variations. These conditions make direct measurement impossible and compromise the reliability of standard sensors.

Therefore, the measurement must be performed using a cold dry extractive system, which uses a gas dryer before the analysis stage.

Sampling and conditioning ensure that the analysed gas complies with the analyser's operating limits, ensuring an accurate and representative measurement of the gas concentration in the furnace.

Customised study and design of a hydrogen analysis solution

Each project begins with a detailed study aimed at designing a measurement solution that is perfectly suited to the furnace and its specific constraints. Fuji Electric engineers analyse the gas matrix, temperature and pressure conditions, the length of the sampling line, and safety requirements.

This step determines the most resistant materials, the type of cooling to be used, the appropriate filtration, and the optimal flow rate setting to ensure that the sample supplied to the analyser is representative and complies with its operating limits. The goal is to ensure stable and repeatable measurement throughout the thermal cycle.

Analysis solution for hydrogen measurement in heat treatment

The Fuji Electric solution is based on an integrated approach combining hardware components, custom engineering, and comprehensive technical support. It includes:

High-temperature probe:

Designed to withstand extreme conditions up to 1300°C, it guarantees reliable and consistent sampling at the heart of the furnace. It consists of a heated filter with the option of back-blowing (air or neutral gas) for furnaces with high dust loads.

Gas conditioning system:

Sample treatment through fine filtration, drying, and gas flow regulation, ensuring accurate and stable measurements.

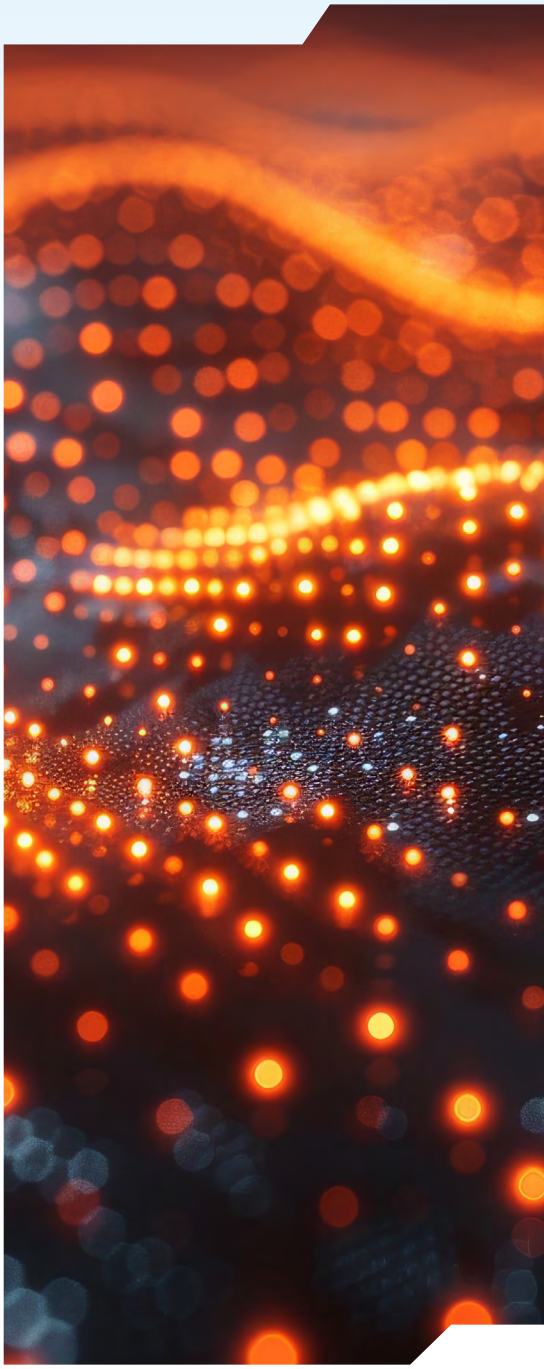
Thermal conductivity gas analyser - ZAF:

The gold standard in hydrogen measurement, offering ±1% accuracy and excellent repeatability.

Fuji Electric support:

From initial design to commissioning, comprehensive expertise to guarantee system performance, reliability, and compliance. The ultimate goal is to offer a tailor-made solution adapted to the process.

This comprehensive solution provides reliable, continuous measurement that meets the quality, safety, and performance requirements of heat treatment processes.



Your advantages

+ **Benefit from a turnkey solution**
  Designed, tested, and commissioned by Fuji Electric France technical teams.
+ **Local assembly in France**
  System assembled in Clermont-Ferrand to guarantee quality and responsiveness.
+ **Optimise treatment quality**
  Thanks to stable and repeatable measurement of hydrogen concentration.
+ **Guarantee process safety**
  By continuously monitoring reducing gases in a controlled atmosphere.

The solution for measuring hydrogen in extreme conditions

- **High-precision thermal conductivity measurement**
  Repeatability of ±1%
- **Interference management and processing**
  Possible integration of complementary analysers (CO_2, CO) with application of appropriate correction calculations
- **Capacity to operate in extreme conditions**
  Resistance up to 1300 °C and high pressure tolerance
- **Gas conditioning system adapted to processes**
  Ensures that gas parameters remain within the analyser's operating limits
- **Available customization options**
  Integration of a solenoid valve to simplify calibration or an HMI interface for data display, depending on requirements
- **Technical study and support Fuji Electric France**
  Needs analysis, solution design, commissioning, and customised training

Gas analyser - ZAF

Configuration example

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