

#### Keywords

- Alloys quality
- Hydrogen controlled atmosphere
- Heat treatment process
- Bell furnace
- Hydrogen gas analyser



#### Context

Heat treatment processes require a precisely controlled atmosphere in order for the process to be successful. These processes are often used to manufacture special alloys critical parts for industries such as aerospace, automotive, petrochemical or nuclear energy.

#### Challenges

The lack of a controlled atmosphere could lead to chemical reactions on the surface of the metal alloy to be heat treated, compromising its quality and performance and leading to rejected parts. Such conditions lead to financial loss, wasted time, and potentially dangerous repercussions for the customer who use the part without detecting the weakness. In addition, an improperly controlled atmosphere could lead to a damaged furnace or, worse yet, injured employees.

## The Fuji Electric solution

### Accurate control of the atmosphere in heat treatment furnace

The inert gases most commonly used in heat treatment processes are argon (Ar), helium (He), and nitrogen (N<sub>2</sub>). The degree to which an atmosphere can be called inert depends on factors such as the type of gas, its level of purity, the temperatures involved, and the material being processed. Depending on the gas or gas mixture used, the process will be dedicated to different heat treatment types: annealing, neutral hardening, tempering, nitriding, sintering or brazing.



Fuji Electric gas analysers are used to control the atmosphere in all of these processes, with capabilities to measure fast and precisely ratios such as Ar/He, Ar/N<sub>2</sub>, He/N<sub>2</sub>, H<sub>2</sub>/Ar or H<sub>2</sub>/N<sub>2</sub>.

The latter one is required to control a hydrogen-rich atmosphere. This is implemented to reduce iron oxide to iron and decarburize steel. It also effectively aids in heat transfer and can react with any oxygen present.

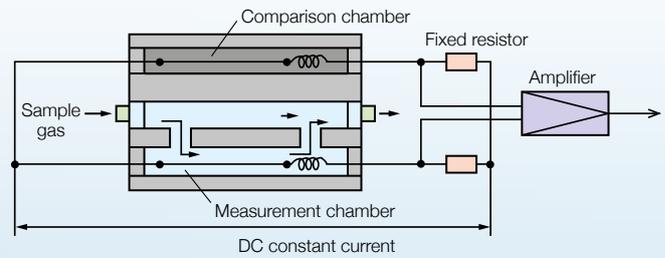
The Fuji Electric Solution to control the H<sub>2</sub>/N<sub>2</sub> for instance is a small industrial cabinet which integrates the Thermal Conductivity Detection (TCD) analyser called ZAF, and a specifically adapted gas sampling system. The gas sampling system is designed according to the furnace operating conditions.

#### For example :

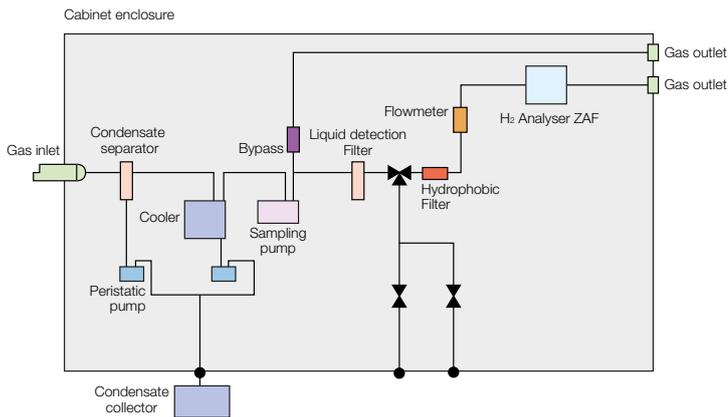
- Temperature > 1000°C
- H<sub>2</sub> > 50%
- High levels of humidity during low hydrogen phases
- Significant amount of solid particles

## Fuji Electric ZAF analyser TCD principle

Because the thermal conductivity is different among gas components, when there is a change in the concentration of the component under measurement, the thermal conductivity of the sample gas will change to affect the temperature of the platinum wire. The analyser uses the temperature change to determine the gas concentration.



## Heat Treatment Furnace control gas analyser system design



The furnace gas is continuously extracted by a heating and filtering sampling probe.

Then it is led through a heated sample line to the wall mounted small cabinet integrating the TCD analyser and the whole specifically designed sample treating system required both to keep the analyser safe and to ensure accurate, representative and reliable H<sub>2</sub> concentration measurement.

## Your advantages

- Ensure a perfectly controlled atmosphere of your heat treatment process.
- Keep your customers satisfied, delivering the best quality level of high purity alloys.
- Increase profitability with no rejected products most frequently due to a degraded atmosphere.



# H<sub>2</sub>, Ar, He, CO, CO<sub>2</sub>, CH<sub>4</sub>, O<sub>2</sub> or humidity gas analyser system for heat treatment furnace



## Easy installation and operation

The ZAF gas analyser system is delivered as a turnkey instrument. After delivery, it is ready to be connected, calibrated and operated.

## A solution designed for your furnace

Tailormade analytical system to fit exactly with your process and environment conditions such as temperature, amount of dusts, gas components and concentrations, humidity.

## Large flexibility and wide ranges of applications

For new and existing furnaces, adaptable to most types of controlled atmospheres. Up to 8 gas components can be measured separately or simultaneously.

## Data you can trust

High precision TCD gas analyser with guaranteed specifications. Cross-interference are cancelled thanks to a smart calculator.

## Easy maintenance and long service intervals

Sample gas treatment system is composed of robust components and filters easy to exchange.

## Relax, your furnace atmosphere is controlled by a Fuji analyser

Take advantage of 57 years of experience with industrial gas analysers in the metal industry.



TCD - ZAF  
gas analyser



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