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Application note

Hydrogen content in heat-treating furnace atmospheres

Benefits

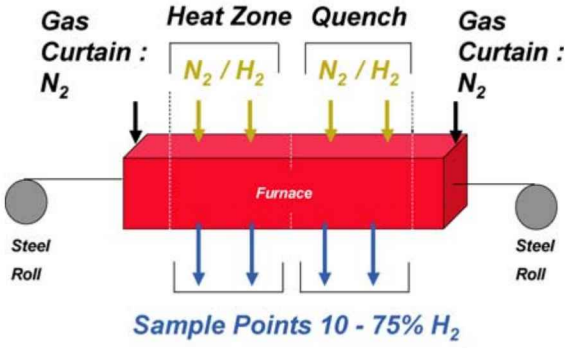
- Automated field calibration
- Reliable sensor; does not rely on a chemical reaction nor gas adsorption
- Rugged design for demanding environments
- Turnkey system with simultaneous hydrogen, trace oxygen and trace moisture analyzers

Summary

Metal parts, alloys and sheet steel are processed in furnaces at elevated temperatures. Controlled atmospheres are used to infuse desired properties and in pretreatment for depositing coatings. Hydrogen concentrations in the furnace atmosphere must be precisely controlled to optimize the finished product yield and quality.

Application

Mixtures of hydrogen and nitrogen are used to reduce metal oxides. At elevated temperatures, hydrogen reacts with metal oxides producing water vapor and yielding bright, shiny, defect-free metal. In addition, hydrogen is injected into furnace annealing zones to cool the material at prescribed rates in process known as jet cooling. Accurate and repeatable hydrogen concentrations are required to optimize the yield and reduce scrap rates.



Challenge

A furnace environment is far from an ideal location to install a sensor. The temperature is elevated, and the furnace gas contains particulates including vaporized metal and metal oxides, oils and soot. A sample of the furnace gas is extracted and cooled by utilizing a vacuum pump or eductor (venturi) and a series of filters. The environment in a metal processing facility is demanding and requires a heavy-duty industrial analyzer. To ensure accurate hydrogen concentrations, the analyzer must have the capability to be field calibrated.

Solution

Baker Hughes XMTC thermal conductivity analyzer assembled into a sample system continuously measures the percentage of hydrogen and transmits the measurement to a data acquisition and control system. The XMTC utilizes the difference in thermal conductivity between hydrogen and the background gas. It has no moving parts and does not rely on a chemical reaction nor gas adsorption. The XMTC is supplied with a display/controller which may be programmed to run the calibration process at a predetermined time.

Application specifications

- Range: 0-100% hydrogen
- Process temperature: 1000-2500°F
- Pressure: Atmospheric

Panametrics, a Baker Hughes Business, provides solutions in the toughest applications and environments for moisture, oxygen, liquid and gas flow measurement. Experts in flare management, Panametrics technology also reduces flare emissions and optimizes performance.

With a reach that extends across the globe, Panametrics' critical measurement solutions and flare emissions management are enabling customers to drive efficiency and achieve carbon reduction targets across critical industries including: Oil & Gas; Energy; Healthcare; Water and Wastewater; Chemical Processing; Food & Beverage and many others.

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