Heat Treatment and Hardening Process
Hydrogen Process Gas Analyzer

Basics and background

Heat treatment under a controlled gas atmosphere is important for optimal product quality. Several stages – inertization, oxidizing, reducing, carburizing and decarburizing – can play an important role and continuous measurement is required to achieve good results.

During the heat treatment and hardening process hydrogen (H_2) and carbon monoxide (CO), carbon dioxide (CO_2) and methane (CH_4) as well as oxygen (O_2) or water vapor (H_2O) play a role for carbon and oxidation potential. For nitriding or carbonitriding nitrogen and/or ammonia (NH_3) are also used. Monitoring of the process gas atmosphere using process gas analyzers is therefore an important requirement for adjusting and monitoring the precise gas composition to achieve reliability, profitability and product quality.

Solutions – Use of hydrogen process gas analyzers

The purpose of determining the hydrogen, methane, carbon monoxide, carbon dioxide contents in the carburizing furnace is to detect operational or furnace problems. In case of nitriding monitoring of the hydrogen and ammonia concentration is required. For carbonitriding a high temperature measurement of hydrogen, ammonia, carbon monoxide, carbon dioxide and water vapor in a high temperature analyzer is required to avoid dew point problems or ammonia salt precipitations in the sample gas lines. The hydrogen component can be monitored with a CONTHOS 3 – TCD HT gas analyzer or a TCD module in a high temperature analyzer. Most other components such as CH_4, CO, CO_2, NH_3 and/or H_2O require a thermostat controlled NDIR, TDL, FTIR or a similar method. For oxygen measurement ZrO_2 or TDL can be used as high temperature versions.

The highly corrosion resistant thermal conductivity detector with aluminum oxide ceramic, glass and quartz coated platinum measuring filaments ensures long-term stability for this measurement over several years. Stainless steel tubing can be provided as high pressure and temperature resistant versions providing a very gas-tight measurement. The CONTHOS 3 – TCD can, for example, analyze 0 – 50% H_2, 0 – 80% H_2 up to 0 – 100% H_2. Up to 3 measured NDIR components can be used for cross compensation of the thermal conductivity measurement.

For hazardous areas the CONTHOS 3 - TCD Ex p as an ATEX compliant Ex p system is available as well, including an infallible containment.

Conclusions

The special performance and resistance of the LFE CONTHOS 3 – TCD or CONTHOS 3 -TCD HT for analysis of H_2 with flexible measuring ranges helps to monitor and analyze the H_2 content in the carburization, nitriding or carbonitriding process atmosphere. This enables the continuous control of the production and quality control leading to optimal process performance.

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