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SE-NH3GA-CN

Stationary residual NH_3 analysis for Carbonitriding

Carbonitriding is commonly used for the heat treatment of unalloyed and low-alloyed components. The aim is to improve the surface properties by introducing carbon and nitrogen.

The carbon input can be controlled by an oxygen sensor (C-level probe). A measure of the nitrogen input is the reaction behavior of the NH_3 on the component surface.

Up to now, fixed NH_3 quantities have been added to the process in the heat treatment programs and the C level has been controlled in parallel via the C level probe. There has been no measurement of the nitrogen concentration (nitrogen concentration depths in the component) in the reaction atmosphere to date.

In practice, it can be observed that despite unchanged temperature, C-level, NH_3 quantity, batch size, etc., differences in the heat treatment result can occur. Therefore, it would be important to use a suitable sensor, in addition to the C-level probe, for atmospheric monitoring on the furnace equipment.

A measure for the reaction behavior of the NH_3 is the residual NH_3 in the exhaust gas of the furnace system. Goal is a controlled carbonitriding.

Control of the process is only possible if the residual NH_3 content is known. The atmosphere consists of approx. 20% CO, 40%H_2, 1%CO_2, residual N_2.

In order to realize carbonitriding, a maximum of 5% NH_3 is added in proportion to the amount of fresh gas (endogas + enriching gas). This splits into H_2 and atomic nitrogen to diffuse into the iron structure. Residual NH_3 that has not reacted with the batch surface is the measure of N diffusion. This is to be measured and controlled.

This can only be realized by means of an NH_3 measuring cell with a control range of 0 ... 5000 ppm and a good stability of the measuring cell at higher concentrations.
The measuring range of the measuring cell should be 0 ... 1% NH_3 to obtain reliable measured values even in the initial phase of the process.

A modified optical gas sensor, which works on the principle of non-dispersive infrared absorption of gases, can be used to determine the residual NH_3 in the atmosphere.

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DESCRIPTION OF THE MEASURING DEVICE

Measuring range:	0 - 0,5 vol.% NH_3
Measuring cell temperature:	Constantly controlled internally!
Control range:	4000ppm and less than 300ppm NH_3 in the reaction gass
Control of NH_3 addition:	via measurement of residual NH_3
Measurement in the exhaust gas:	via sample gas pump behind the measuring cell
Sample gas temperature:	maximum 1000°C
Measurement temperature range:	750°C - 950°C, concentrations of max. 5.0 Vol.% can occur in this case
Sample gas pressure:	slight overpressure max. 50 mbar
Reaction gas composition:	20 Vol.% CO, 1,0 Vol.% CO_2 40Vol.% H_2, 1,0 NH_3, residual N_2
Approximate data:	CO can be from 15% - 22% and CO_2 from 0.01 - 1%. Depending on the CO value and the addition of NH_3, which does not react, the H_2 value can be from 30% - 44%.
Process control:	If the process is properly controlled, soot or condensate in the exhaust gas can be excluded
Gas conditioning:	Filter, sample gas pump
Output signal / interface:	4-20 mA linear to the measuring range
Degree of protection:	IP 56
Supply voltage:	24 VDC
Warranty:	1 year if used as intended and maintenance is observed.

MEASUREMENT PRINCIPLE

Optical gas sensors (NIDR) operate on the principle of non-dispersive infrared absorption of gases at specific wavelengths. Such sensors are characterized by high selectivity, i.e. low cross-sensitivity to other gases in a mixture. Another advantage is the comparatively long lifetime (usually > 5 years).

The radiation spectrum that is absorbed corresponds to the wavelength of the molecular vibration in the respective gas. Thus, an exact determination of the gas constituent in a gas mixture is possible even at low gas concentrations. There is no cross interference with the usual reaction gas compositions in carbonitriding.