ON-900 | OH-900 | ONH-2000 | H-500

ELTRA
ELEMENTAL ANALYZERS

Oxygen / Nitrogen / Hydrogen Analyzers

ON-900 | OH-900 | ONH-2000 | H-500

ELTRA
Impulse furnace with ramping for fractional analyses!
ONH-2000

part of VERDER scientific

ELTRA
ELEMENTAL ANALYZERS

Specialists for Elemental Analysis

For more than 30 years ELTRA has been one of the leading manufacturers of elemental analyzers. Starting with combustion analyzers for carbon and sulfur determination ELTRA has extended its product range over the years with analyzers for oxygen, nitrogen and hydrogen as well as thermogravimetric analyzers. ELTRA instruments are used in industries such as steel, mining, automotive and aviation, construction materials and in universities for Research & Development.

ELTRA is synonymous for high quality, customer-oriented solutions and efficient products. Thousands of satisfied customers worldwide are proof of the reliability of ELTRA analyzers.

Oxygen, Nitrogen, Hydrogen Analysis

Oxygen, nitrogen and hydrogen strongly influence the properties of metals (like steel, titanium, copper) which makes a reliable and precise measurement of these elements an important part of the quality control process. ELTRA supplies analyzers for the determination of the single elements O, N, H as well as combined solutions for analyzing ON, OH or ONH.

ELTRA analyzers use inert gas fusion. This method involves heating the sample in an impulse furnace which is capable of reaching temperatures in excess of 3,000 °C. The sample is melted in a graphite crucible, oxygen is determined by non-dispersive infrared cells as CO_2, nitrogen and hydrogen by a thermal conductivity cell. Typical samples for ONH analysis are metal alloys (steel, copper, refractory metals) as well as ceramics and other inorganic materials. The H-500 is available exclusively for the determination of hydrogen based on hot extraction analysis.

Oxygen / Nitrogen / Hydrogen Analyzers

for inorganic sample materials

for inorganic sample materials

ELTRA also provides analyzers for:

CS in inorganic samples

The **CS-800** is ideal for the quick simultaneous determination of carbon and sulfur in steel, cast iron, nonferrous metals, carbides, ceramics, glass, cement and other inorganic samples.

CHS in organic samples

The **CHS-580** is used for the quick simultaneous determination of carbon, hydrogen and sulfur in samples such as coal, coke, ores, minerals, slag, and many more.

Thermogravimetry

The **Thermostep** analyzer allows for determination of different sample parameters such as moisture, volatiles, and ash in one single analysis cycle.

Oxygen / Nitrogen / Hydrogen Analyzers

ON-900 | OH-900 | ONH-2000

Oxygen Nitrogen Hydrogen Impulse furnace

Precise and reliable element analysis

Benefits

- Flexible configurations and measuring ranges for O, N and H
- Powerful 8 kW impulse furnace for temperatures in excess of 3,000 °C
- Short analysis time
- Ramping and fractional analysis included
- Economic analysis of grains without capsules
- High sensitivity with low detection limits

ELTRA's ONH series determines oxygen, nitrogen and hydrogen in inorganic samples via inert gas fusion in an impulse furnace with temperatures in excess of 3,000 °C. ELTRA provides analyzers which determine the single elements O, N and H as well as the combinations OH, ON and ONH.

The ONH series guarantees precise and fast sample analysis. The analyzers cover a wide range of applications such as metal, ceramics and other inorganic materials. The ONH series can be supplied with up to two infrared cells with different path lengths, accommodating both high and low level oxygen analysis.

Typical sample materials

Steel, cast iron, copper, refractory metals, ceramics and many more

ELTRA ONH series

Quick results thanks to easy operation

Operation of the ONH analyzers is simple and safe. The samples are weighed on the interfaced balance and the weight is transferred to the linked PC. Manual weight entry is also possible. The sample is placed into the loading head and the empty graphite crucible is put on the lower electrode tip. Depending on the application the addition of auxiliary materials which lower the melting point, such as tin or nickel, may be required. The analysis time is 2 to 3 minutes, depending on the application parameters. Cell outputs are displayed in real time. All peak profiles are saved on the data base along with the results. Also all results can be transferred to a "Laboratory Information Management System" (LIMS). The ONH series requires minimum maintenance. The particle filters and chemicals which need to be maintained are easily accessible.

Weighing the sample

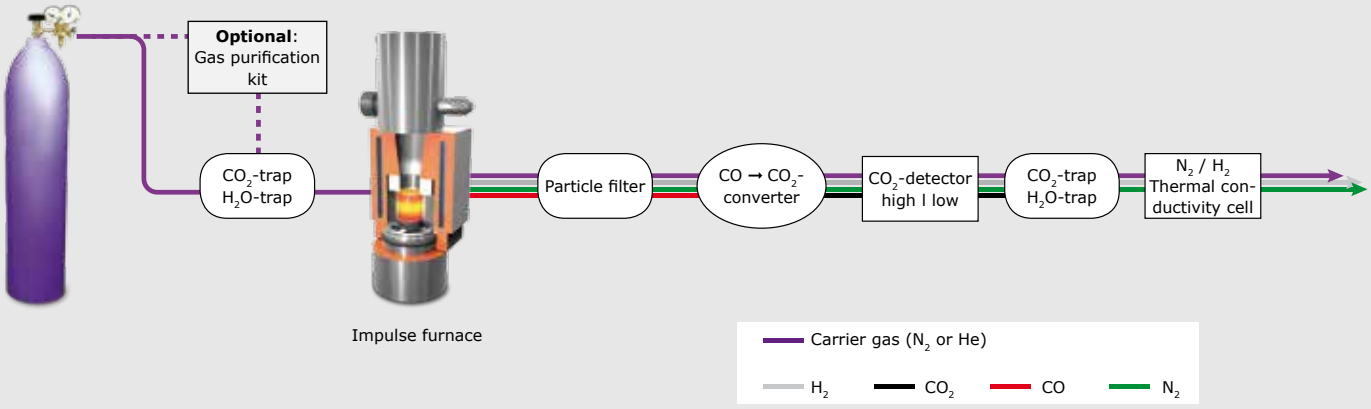
Feeding the sample to the furnace

Display of analysis results

Precise and robust measuring system

The measuring principle of the ONH series allows for a wide measuring range. To analyze the sample, it is weighed and placed in the sample drop mechanism Flushing with carrier gas prevents atmospheric gas from getting into the furnace. The graphite crucible is outgassed in the impulse furnace to reduce possible contaminations (e.g. residual hydrogen). After a stabilization phase the sample is dropped into the crucible and melts. Carbon monoxide is produced by the reaction of carbon in the graphite crucible and oxygen of the sample. Nitrogen and hydrogen are released in its elemental form. The carrier gas (helium) and sample gasses pass through a dust filter before entering a copper oxide catalyst which converts the CO to CO_2. The CO_2 is measured by the infrared cells to determine the oxygen content. CO_2 and water are removed chemically and the nitrogen content is measured in the thermal conductivity cell.

In the case of hydrogen analysis the nitrogen carrier gas passes through Schuetze reagent instead of a copper oxide catalyst.



Technical Details

ON-900 | OH-900 | ONH-2000

ELTRA
Robust analysis technique for inorganic samples
ONH series

The ONH series uses inert gas fusion with an impulse furnace for analysis of oxygen, nitrogen and hydrogen. The furnace provides temperatures in excess of 3,000 °C. For some samples the addition of flux melting agent such as nickel or tin, may be required to achieve optimum fusion. The performance of the ONH analyzers can be controlled in steps up to a maximum of 8 kW.

Oxygen determination with up to 2 independent infrared cells

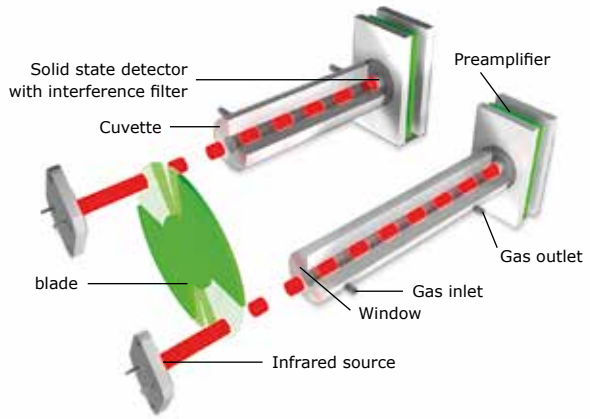
Benefits

- Long term stability
- Low maintenance
- High operation life

The design of the ONH series infrared cells is proven to be robust. The use of a constant radiant IR source combined with a chopper blade is historically proven to be extremely reliable, offering a significantly longer operating time when compared to the chopper-less flashing IR source.

The stability of the baseline, as well as the thermo control of the IR cells is monitored by the software. The analyzers can be supplied with up to two independent IR cells. The length of each cell can be manufactured to give the optimum measuring ranges.

Graphic: Infrared cells with flexible measuring range



Easily accessible particle filters and chemicals

All particle filters and chemicals which need to be changed on a regular basis are clearly assembled, easily accessible from outside and quickly exchangeable. The open assembly also allows for convenient visual control.

N_2, H_2 Thermal conductivity cell with wide measuring range

Nitrogen and hydrogen concentrations are determined in the ONH series by a robust and sensitive thermal conductivity cell. The cell is based on a micro-mechanical silicon chip and works independent from a reference gas flow. The chip is integrated into a stainless steel housing where the measuring gas flows through. This arrangement provides a stable measurement of concentrations independent of gas flow and pressure over a wide range. The ELTRA thermal conductivity cell is characterized by long term stability and high sensitivity. The temperature of the thermal conductivity cell and the baseline stability are controlled by the software additionally.

Benefits

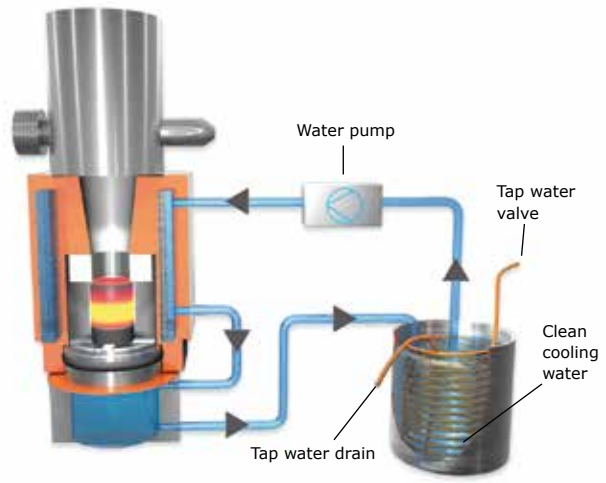
- High sensitivity
- Long term stability
- No reference gas flow needed

Powerful and efficient cooling system

The ONH series has a primary and secondary cooling system. The separate circulation system prevents contamination from halogens and carbonates in the cooling water.

The electrode cooling water is temperature controlled by means of a secondary cooling coil which is situated within the water tank. A thermostatically controlled valve opens to allow tap water into the secondary coil, this cools the electrode cooling water. The valve closes when the electrode water temperature falls to below 35 °C. ELTRA also offers optional external cooling.

Graphic: Cooling system of the ONH series



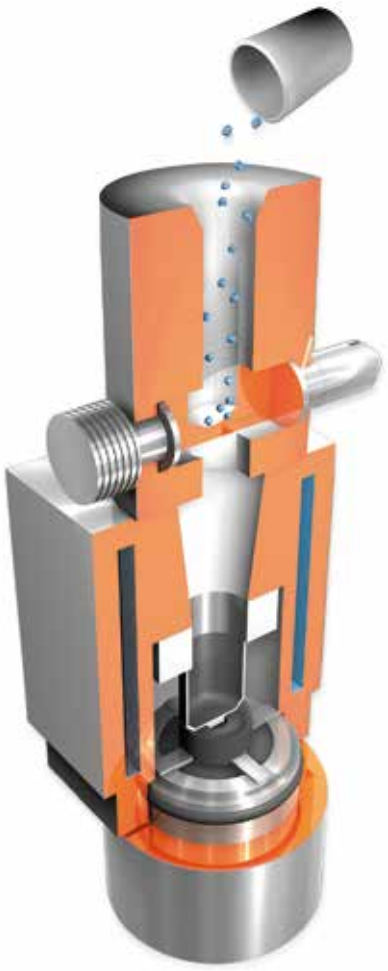
High-performance furnace technology – impulse furnace in excess of 3,000 °C

Impulse furnace

The ONH series is equipped with an impulse furnace providing temperatures in excess of 3,000 °C. The design and composition of the electrodes, sample drop mechanism and electrode contact are particularly user-friendly.

Benefits

- Low maintenance system
- Simple operation
- Low analysis costs
- No furnace contamination



Graphic:
ONH impulse furnace

Sample analysis without capsule

The design of the sample drop mechanism allows for easy analysis of grains and drillings without the use of capsules. Advantages include

- No blank values caused by the capsule material or air inclusion
- No furnace contamination (evaporation and condensation at the electrode) caused by capsule material, low maintenance system
- No filling of capsule required
- Reduced analysis costs
- A wide furnace is optionally available for larger sized samples

Robust Graphite tip

- More efficient heat transfer than with metal tips
- Low-wear construction
- Less power loss
- Easy exchange of electrode tip

Graphic:
Graphite tip

Convenient upper electrodes

The upper electrode of the impulse furnace is equipped with a replaceable insert.

- Quick, easy and economic replacement by user

Graphic:
Electrode

Stand-by mode for minimum consumption of carrier gas

In stand-by mode the gas consumption is automatically reduced. A low flow rate prevents ambient air from entering the system. The regular flow is automatically restored as soon as the analyzer is used. Due to the flushing during the stand-by phase, the analyzer is ready for operation in no time. This function is activated via the software.

Wide range of accessories

For special requirements in laboratories and production the ELTRA ONH series can be equipped with various options. Gas purifier kits are available for all ONH analyzers for applications involving element analysis at sensitive ppm levels. Gas calibration is another option. For the OH-900 and the ONH-2000 analyzer ELTRA offers an external module with quartz tube to determine residual hydrogen by hot extraction.

Precise calibration of the analyzer

In addition to calibration with standards (solid materials), the analyzers of the ONH series can be equipped with a gas calibration tool. This allows to exactly control the amount of gas, thus offering another possibility of calibration and quality control.

Effective carrier gas purification

For reliable analysis in the sensitive ppm level, a gas purifier is available to effectively reduce the blank values of the carrier gas.

Optional module for hot extraction analysis of hydrogen for OH-900 and ONH-2000

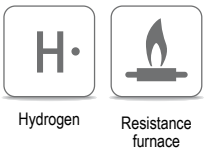
For the characterization of some materials a comprehensive hydrogen analysis is required. In addition to determination of the total hydrogen content in an impulse furnace (OH-900 or ONH-2000), an optional module for the determination of diffusible and residual hydrogen is available.

Benefits

- Comprehensive hydrogen analyis with one measurement cell
- Flexible and economic analysis
- Measurement of large samples (e. g. weldseam) possible
- Variable temperature regulation up to 1,000 °C

Hydrogen Analyzer

H-500



Precise H_2 determination even of large samples

Benefits

- High-capacity thermal conductivity cell
- Easy calibration with standards or gas dosing
- Precise measurements even for low concentrations
- For samples of up to 10 g and 0.8 x 6 cm size

For the determination of the total hydrogen content in inorganic samples by inert gas fusion in an impulse furnace both the OH-900 and the ONH-2000 are suitable. Another option is ELTRA's H-500 which determines hydrogen by hot extraction in a quartz tube.

Both inert gas fusion in an electrode furnace and hot extraction in a quartz furnace are established methods for the determination of the hydrogen concentration. The H-500 is equipped with a resistance furnace with quartz tube which can be heated to 1,000 °C. By using nitrogen as carrier gas and a thermal conductivity cell with up to two degrees of sensitivity concentrations on a low ppm level can be determined precisely and reliably.

Typical sample materials

Steel, iron, copper, weldseams and many more




Hydrogen analyzer H-500

Operation H-500

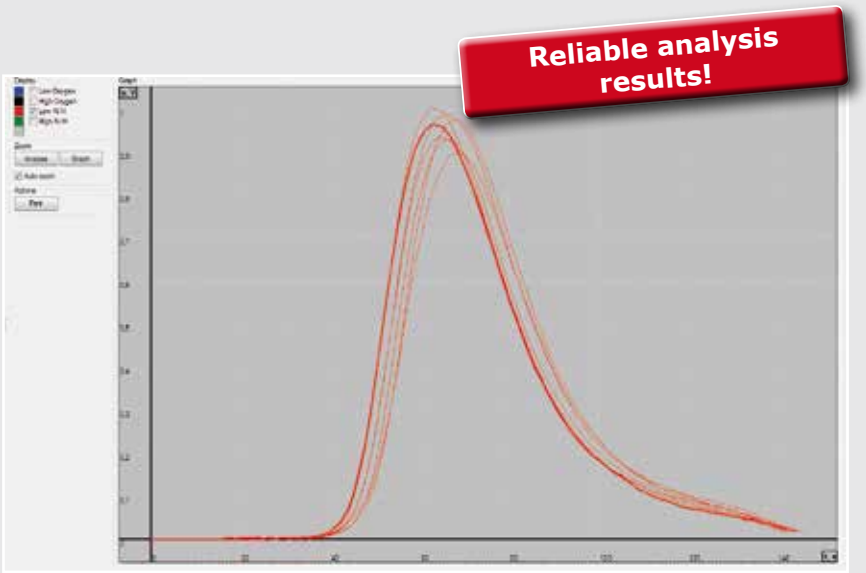
Operating the H-500 is simple and safe. After weighing the sample on the interfaced electronic, the weight is transferred to the connected PC. It is also possible to enter the weight manually via the H-500 software. The sample is placed into the cold zone of the horizontally positioned furnace (fig. 1). After starting the analysis, the furnace is rotated upwards (fig. 2) for the sample to fall into the hot zone. By adding nitrogen as carrier gas hydrogen diffuses out and is carried into a sensitive thermal conductivity cell. The typical analysis time is about 3 to 15 minutes. Detector signals and instrument parameters are displayed during analysis. Evaluation of the signals and display of the results are done automatically; the data can be transferred to a laboratory information management system (LIMS). The H-500 requires minimum maintenance. The particle filters and chemicals which need to be maintained are easily accessible

1

2

Application | Example: Hydrogen standard AR 556 from Alpha Resources

To determine the content of diffusible and residual hydrogen in a steel sample only a resistance furnace with quartz tube is suitable as a temperature of up to 1,000 °C is required and the sample length is usually several centimeters (H-500: 6 cm). ELTRA's H-500 provides precise analysis results even in the low ppm range.

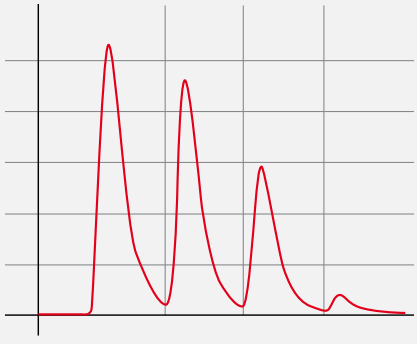


Sample weight	Hydrogen content
1,001.4 mg	6.55 ppm H
1,002.1 mg	6.73 ppm H
999.5 mg	6.55 ppm H
1,000.1 mg	6.67 ppm H
1,000.9 mg	6.41 ppm H
999.8 mg	6.45 ppm H
1,001.5 mg	6.69 ppm H

PC control with Windows®-based software

ELTRA's instrument software ensures convenient control and operation of the ONH analyzers and the H-500. It is multilingual, easy to understand and provides the following features:

- Custom layouts: user-defined display of windows and storage of different layouts
- User profiles with multi-level access: creation of different hierarchy levels with different authorizations
- Sample ID memory and serial numbering of samples
- Storage of analysis results in data base: the data of each analysis is stored and can be called up later for reviews, reports, statistical calculations or recalculation of results with modified parameters
- Programmable data base filter: user-defined selection of existing analysis data by sample name, date, ID or other parameters
- Visualization of statistical data and results consistency
- Peak separation calculation for fractional analysis
- LIMS communication and data export
- One point or multi point calibration
- Barometric pressure compensation
- Simultaneous calibration of more than one measuring range
- Automatic linearity correction
- Applications memory and display of maintenance intervals: individual configuration of maintenance intervals
- Hardware diagnostics display and print-outs of technical reports



Fractional analysis (Ramping)

Fractional analysis (Ramping) for ONH series

The software of the ONH series allows gradual heating and fractional analysis.

- Heating rates can be set according to application requirements
- Correlation of temperature and power possible
- Graphic display and evaluation of the characteristic finger print

ELTRA's ONH analyzers and the H-500 fulfill the requirements of all relevant standards

ASTM standard compliance with regards to oxygen, nitrogen and hydrogen determination

Standard	Material to be analyzed	Standard title
E-1019	Steel, Iron, Nickel, Cobalt Alloys	Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques
E-1587	Nickel	Standard Test Methods for Chemical Analysis of Refined Nickel
E-1409	Titanium and titanium alloys	Standard Test Method for Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique
E-1569	Tantalum	Standard Test Method for Determination of Oxygen in Tantalum Powder by Inert Gas Fusion Technique
E-2575	Copper and copper alloys	Standard Test Method for Determination of Oxygen in Copper and Copper Alloys
E-1447	Titanium and titanium alloys	Standard Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity/Infrared Detection Method

ISO standard compliance with regards to oxygen, nitrogen and hydrogen determination

Standard	Material to be analyzed	Standard title
10720	Steel and iron	Steel and iron – Determination of nitrogen content – Thermal conductimetric method after fusion in a current of inert gas
15351	Steel and iron	Steel and iron – Determination of nitrogen content – Thermal conductimetric method after fusion in a current of inert gas (Routine method)
22963	Titanium and titanium alloys	Titanium and titanium alloys – Determination of oxygen – Infrared method after fusion under inert gas
17053	Steel and iron	Steel and iron – Determination of oxygen – Infrared method after fusion under inert gas
3690	Welding seams (iron, steel)	Welding and allied processes – Determination of hydrogen content in arc weld metal

With the impulse furnace of the ONH series the oxygen, nitrogen and hydrogen concentrations of a variety of samples can be quickly and reliably determined. The analyzers are suitable for a vast range of inorganic solid samples.

Typical sample materials

Steel, copper, titanium, lead, ores, ceramics

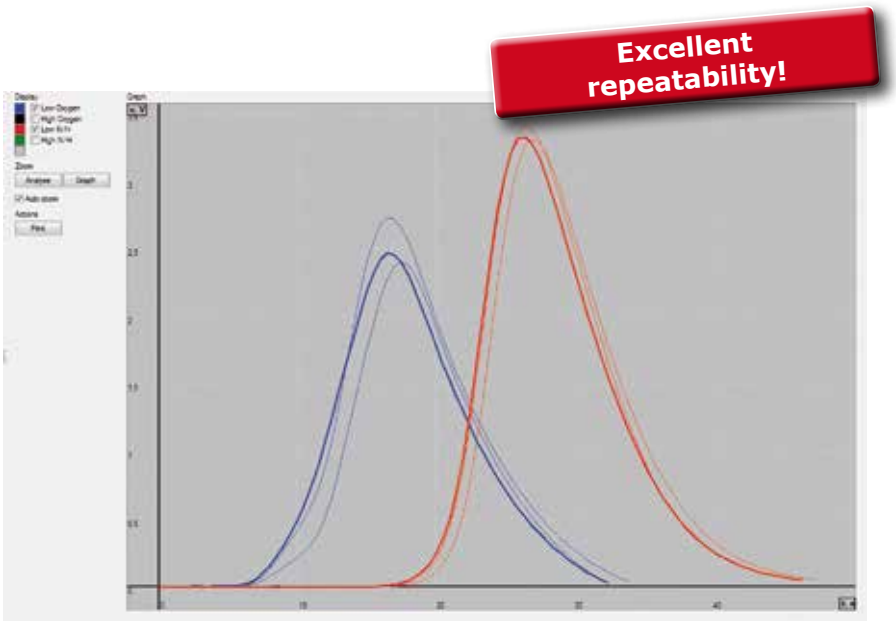



Example:

Oxygen and nitrogen in steel

Oxygen and nitrogen considerably influence the material properties of steel, particularly its hardness and corrosion tendency. Therefore determination of these elements is a routine application in the steel industry. A typical steel sample can be analyzed directly in the impulse furnace without adding fluxes. This guarantees simple and reliable nitrogen and oxygen analysis with quick availability of repeatible results.

This method complies with the standards **ISO 10720 and 17053.**



Typical results for steel			
Steel	1,007.2 mg	205.3 ppm O	51.2 ppm N
Steel	1,002.8 mg	203.3 ppm O	50.1 ppm N
Steel	1,006.4 mg	205.6 ppm O	51.8 ppm N
Mean value:		**204.73 ppm O**	**51.03 ppm N**
Standard deviation:		**1.0**	**0.75**

Example:

Oxygen in yttrium-stabilized zirconium oxide

Ceramics with high oxygen concentrations (such as yttrium-stabilized zirconium oxide) can also be analyzed precisely and with easy to handle sample quantities. For this application the sample is weighed into a nickel capsule and the power is adjusted to 5.5 kW.

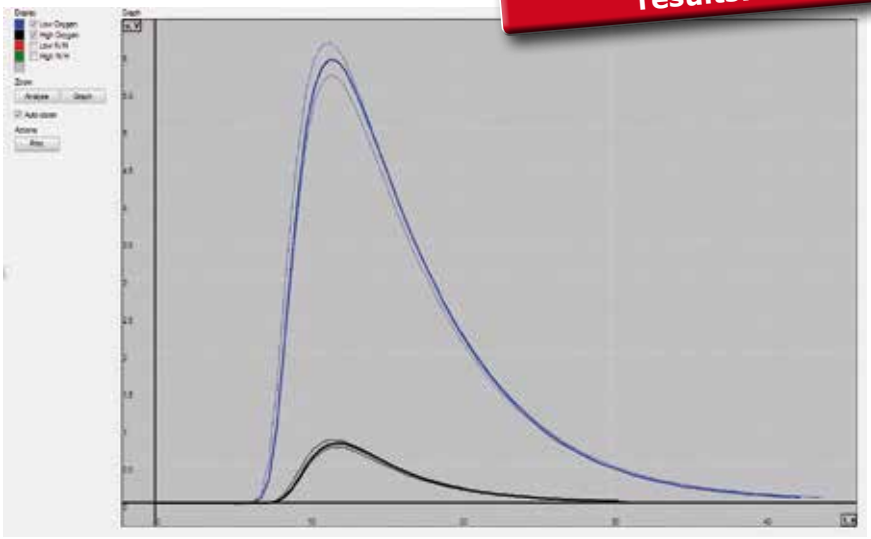
Typical results for ceramics		
$Y\text{-}ZrO_2$	56.5 mg	30.7 % O
$Y\text{-}ZrO_2$	57.5 mg	30.7 % O
$Y\text{-}ZrO_2$	54.0 mg	30.6 % O
$Y\text{-}ZrO_2$	53.1 mg	30.6 % O
Mean value:		**30.65 % O**
Standard deviation:		**0.06**

Example:

Oxygen and hydrogen in copper

Due to its low melting point the analysis of copper can be carried out easily and reproducibly with reduced power (2.4 kW) without addition of fluxes.

Reliable analysis results!



Typical results for copper			
Kupfer	1,015.2 mg	235.1 ppm O	0.45 ppm H
Kupfer	1,016.3 mg	238.7 ppm O	0.47 ppm H
Kupfer	1,015.4 mg	231.3 ppm O	0.41 ppm H
Mean value:		**235.03 ppm O**	**0.44 ppm H**
Standard deviation:		**3.7**	**0.03**

Technical Data

	ONH Analyzers ON-900 | OH-900 | ONH-2000	Hydrogen Analyzer H-500
		
Measuring ranges	**1 g sample**	**1 g sample**
Low oxygen measuring range	0.1 ppm – 200 ppm	–
High oxygen measuring range	10 ppm – 2 %	–
Low nitrogen measuring range	0.1 ppm – 200 ppm	–
High nitrogen measuring range	10 ppm – 2 %	–
Low hydrogen measuring range	0.01 ppm – 50 ppm	0.01 ppm – 50 ppm
High hydrogen measuring range	20 ppm – 1,000 ppm	20 ppm – 1,000 ppm
Sensitivity	**1 g sample**	**1 g sample**
Oxygen measuring range	0.01 ppm	–
Nitrogen measuring range	0.01 ppm	–
Hydrogen measuring range	0.01 ppm	0.01 ppm
Accuracy	**1 g sample**	**1 g sample**
Low oxygen measuring range	±0.1 ppm or ±1 % of oxygen content	–
High oxygen measuring range	±2 ppm or ±1 % of oxygen content	–
Low nitrogen measuring range	±0.1 ppm or ±1 % of nitrogen content	–
High nitrogen measuring range	±2 ppm or ±1 % of nitrogen content	–
Low hydrogen measuring range	±0.05 ppm or ±1 % of hydrogen content	±0.05 ppm or ±2.5 % of hydrogen content
High hydrogen measuring range	±0.5 ppm or ±1 % of hydrogen content	±0.05 ppm or ±2.5 % of hydrogen content
General data		
Standard sample weight	1 g	1 g
Analysis time	2 – 3 minutes (ON or OH mode)	3 – 15 minutes
Furnace	Impulse furnace up to 8 kW, T_{max} >3,000 °C	Resistance furnace up to 1,000 °C
Power supply	400 V AC ±10 % 50/60 Hz 3 phase, max. 8,500 W	230 V AC ±10 % 50/60 Hz 2.0 A; 450 W
Weight	140 kg	40 kg
Dimensions (W x H x D)	55 x 80 x 60 cm	75 x 52 x 60 cm
Chemicals	CO_2 trap sodium hydroxide H_2O trap magnesium perchlorate Copper oxide (ON mode) Schuetze reagent (OH mode)	CO_2 trap sodium hydroxide H_2O trap magnesium perchlorate Schuetze reagent
Measuring principle	Infrared absorption (CO_2) for oxygen, thermal conductivity for nitrogen and hydrogen	Thermal conductivity
Carrier gas (2-4 bar)	Helium 99.995 %(1) (ON mode) Nitrogen 99.995 %(1) (OH mode)	Nitrogen 99.995 %(1)
Compressed air	2 bar	–
Interfaces	seriell and USB	
Accessories	Balance ±0.1 mg resolution Computer, monitor, printer (exact specification on request)	

(1)Purity of 99.999 % in the low measuring range

ELTRA
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Eltra GmbH
Retsch-Allee 1-5
42781 Haan, Germany

Phone +49 21 04/23 33-400
Fax +49 21 04/23 33-499
E-mail info@eltra.org
Internet www.eltra.org

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