ELTRA®
ELEMENTAL ANALYZERS

Oxygen / Nitrogen / Hydrogen Analyzers

NEW

ELEMENTRAC® ON-*p* | OH-*p* | ONH-*p* | H-500

part of VERDER scientific

ELEMENTRAC® ON-*p* | OH-*p* | ONH-*p* | H-500

ELTRA®
ELEMENTAL ANALYZERS

NEW

ELTRA® ELEMENTRAC® Series

The analyzers of ELTRA's new ELEMENTRAC series are a combination of high functionality, elegant design and innovative features. The user-friendly operation, robust construction and precision of the instruments are further indicators of the high product quality.

The ELEMENTRAC ONH series is used to analyze oxygen, nitrogen and hydrogen concentrations in inorganic sample materials reliably, accurately and safely by inert gas fusion.

- ★ Optimized sensitivity thanks to closed gas system
- ★ Use of cost-efficient argon as carrier gas possible
- ★ Water-cooled sample port system
- ★ Improved oxygen analysis due to optimized catalyst furnace
- ★ ELEMENTS software with integrated leakage test and comprehensive diagnosis tools

Oxygen, Nitrogen, Hydrogen Analysis

Oxygen, nitrogen and hydrogen strongly influence the properties of metals such as steel, titanium, copper. Brittleness, ductility and hardness are particularly influenced by the element concentration; hence a reliable and precise measurement of these elements is an important part of the quality control process. ELTRA supplies analyzers for the determination of the single elements O, N, H as well as for the combinations ON, OH and ONH.

The ELEMENTRAC ONH series uses inert gas fusion. This method involves heating the sample in a graphite crucible to 3,000 °C. Oxygen is determined by infrared cells as CO_2, nitrogen and hydrogen are measured by a thermal conductivity cell in their elemental form. Typical samples for ONH analysis are all metal alloys (steel, copper, refractory metals) as well as ceramics and other inorganic materials. ELTRA offers the H-500 analyzer exclusively for the determination of hydrogen in steel based on hot extraction analysis.

Oxygen / Nitrogen / Hydrogen Analyzer

For inorganic sample materials

ELEMENTRAC ONH series **04**

The ELEMENTRAC ONH series uses the inert gas fusion technique for element analysis of inorganic sample materials.

Technical Details **06**

For inorganic sample materials

H-500 **10**

ELTRA's H-500 uses hot extraction with temperatures up to 1,000 °C for the determination of the diffusible and residual hydrogen content in inorganic samples.

Software **12**

Standard-Compliant Work **13**

Applications ELEMENTRAC ONH series **14**

Technical Data **16**

ELTRA also supplies 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

ELEMENTRAC® ON-*p* | OH-*p* | ONH-*p*

Oxygen | Nitrogen | Hydrogen | Impulse furnace

Precise and efficient element analysis

Benefits

- Reduced gas consumption and high sensitivity thanks to closed gas system
- Use of cost-efficient argon as carrier gas possible
- Short analysis times
- Analysis of grains without capsule
- Powerful impulse furnace with 8.5 kW

The analyzers of the ELEMENTRAC ONH series measure the oxygen, nitrogen and hydrogen concentrations in inorganic sample materials by inert gas fusion in an impulse furnace with temperatures in excess of 3,000 °C. They are available for the determination of single elements as well as for measuring combinations of ON, OH and ONH.

The user-friendly concept of the ELEMENTRAC series is based on flexible configuration options and the intuitive ELEMENTS software. The analyzers are equipped with a sensitive yet robust thermal conductivity cell for the determination of hydrogen and nitrogen as well as with up to two infrared cells for accurate and reliable measurement of low and high oxygen concentrations.

Typical sample materials

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

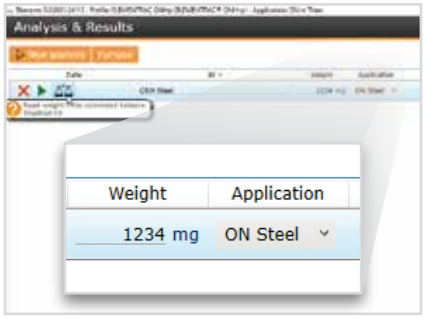
ELEMENTRAC ONH Series

Quick results thanks to easy operation

Operation of the ELEMENTRAC ONH analyzers is easy, safe and convenient. First the sample is weighed, then logged into the sample list and finally introduced to the sample port system. Refractory materials such as titanium or ceramics need to be placed inside a nickel capsule or basket first. The next step is to place a graphite crucible, which may contain more flux melting agent (e. g. tin), on the lower electrode. The analysis is started in the software upon which the impulse furnaces closes. The measurement results are available 2 to 3 minutes later. During analysis it is possible to log in more samples into the sample list or to search for and, if required, export previous measurement results. The ELEMENTRAC ONH series requires minimum maintenance; all chemicals which need to be exchanged regularly are easily accessible.

Turning on the analyzer

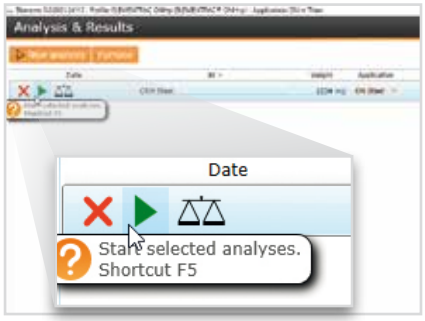
Weighing the sample



Transferring the weight to the software (manual or automatic)

Manual sample feed to the sample port system

Placing a crucible on the lower electrode



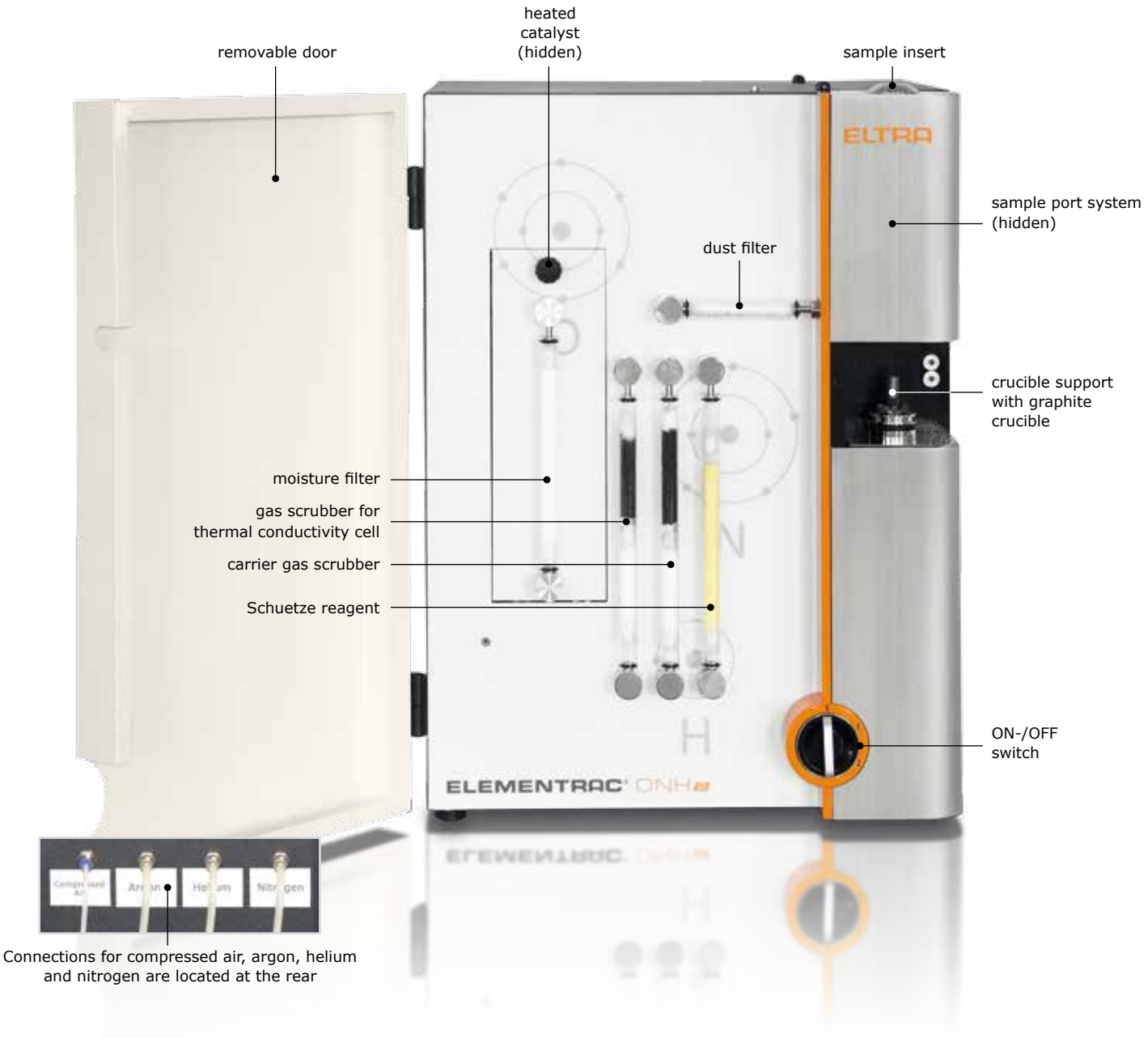
Start of analysis

Display of analysis results

ELTRA
Robust analysis technique for inorganic samples
ONH Series

Superiority in detail – the new ELEMENTRAC® ONH series

The ELEMENTRAC ONH series is characterized by a wealth of innovative details. All chemicals are situated at the front of the analyzers to allow for easy exchanging. Further details, like a removable door, ensure fast, convenient and safe ONH analysis.



Gas system

The ELEMENTRAC ONH series uses a closed gas system in overpressure to ensure that 100 % of the released sample gas is lead to the detectors to guarantee low detection limits and good reproducibility. The efficient economy mode during analysis breaks helps to reduce carrier gas consumption and hence operating cost.

Controlled catalyst with moisture filter

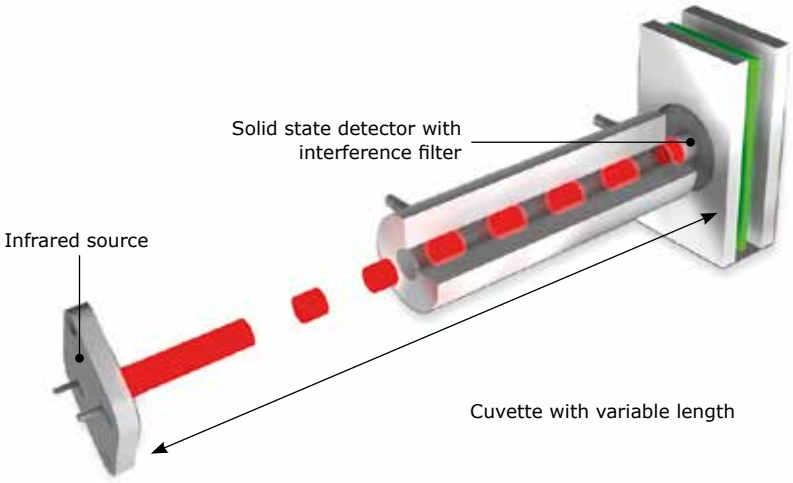
A powerful, controlled catalyst heats the contained copper oxide to 750 °C thus ensuring the complete transformation of the CO formed in the graphite crucible to CO_2. Before the CO_2 analysis in the infrared cells starts, water is chemically bound by a filter to minimize interferences in IR absorption. This ensures reliable oxygen measurement also for low concentrations. The catalyst is integrated in the analyzer and not located at the front. To change the copper oxide it is simply popped out.

Oxygen measurement cells with flexible measuring range

The ELEMENTRAC ONH analyzers use infrared cells to measure the oxygen concentration via the carbon dioxide generated during the analysis process. The length of the cuvette of such an infrared cell determines the sensitivity for measuring very low oxygen concentrations, for example in stainless steel. Shorter cuvettes are suitable for measuring high oxygen concentrations, for example in slag or oxides. ELTRA offers cuvettes with various lengths to guarantee an optimum oxygen measuring range for a variety of applications.

Cuvette length	O_2 measuring range[1]
100 mm	0.1 – 200 ppm
5 mm	10 ppm – 0.7 %
3 mm	40 ppm – 2 %

[1] For 1g of sample. The measuring range can be extended by reducing the sample weight.



Options

The ELEMENTRAC ONH series may be upgraded for specific analytical requirements. The optional package available includes gas calibration, complementing the calibration of solids included in the standard configuration, effective carrier gas purification, an external chiller as well as a support for high-temperature crucibles (HT crucibles) to safely analyze refractory alloys.

Powerful furnace technology and new sample port system: Impulse furnace provides temperatures in excess of 3,000 °C

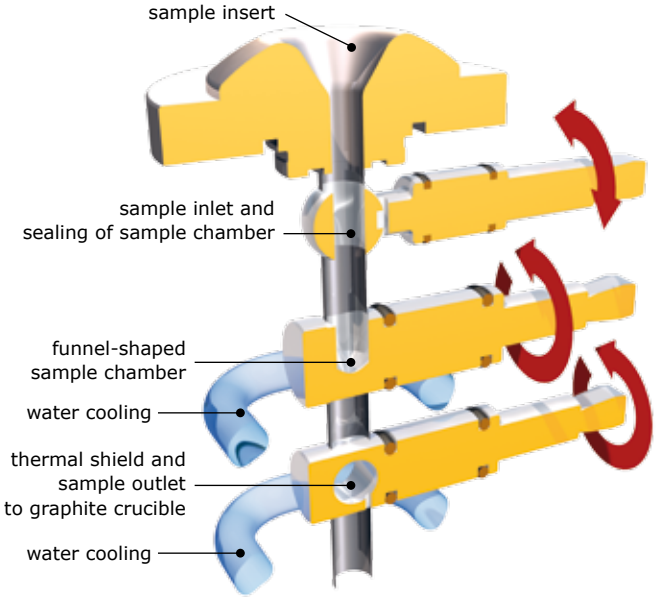
Impulse furnace

The impulse furnace and the sample port system are essential components of the ELEMENTRAC ONH series. The sample port system ensures complete purging of the sample from atmospheric gasses as well as its safe and loss-free transport to the graphite crucible. The sample is melted in the furnace and the contained gasses are fully and uniformly released.

Powerful 8.5 kW furnace

The generator of the ELEMENTRAC ONH analyzers provides 8.5 kW which are reduced to 6.8 kW by the software for safety reasons to avoid burning of the graphite crucibles. This ensures safe operation while still providing sufficient power to analyze refractory samples.

Water-cooled sample port system



The sample is introduced via the sample insert into the funnel-shaped sample chamber. To seal the sample chamber the sample insert rotates and pure carrier gas purges the sample from atmospheric gasses. At the same time the graphite crucible is purged by outgassing. A thermal shield provides protection from the heat generated by this process.

The combination of water cooling and thermal shield in the sample port system makes the ELEMENTRAC analyzers perfectly suited for sensitive hydrogen measurement because heat input during purging, and the resulting hydrogen loss, is prevented. The heat shield opens shortly before the analysis starts and the sample falls from the rotating sample chamber into the hot graphite crucible.

Analysis of grains without capsule

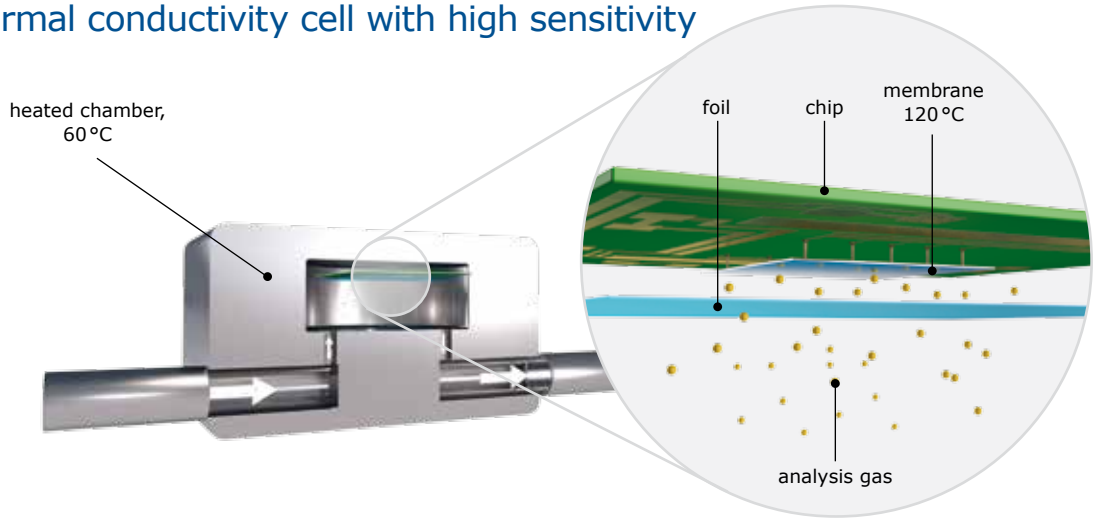
The funnel-shaped sample chamber allows for analysis of grains without the use of capsules which offers some decisive advantages:

- No blank values caused by the capsule material
- No furnace contamination through evaporating/condensating capsule material – less cleaning required
- No time-consuming filling of capsule required
- Reduced analysis costs

Sensitive thermal conductivity cell with optional use of argon

Whereas the oxygen content of a sample is measured with infrared cells, hydrogen and nitrogen are determined in their elemental form with the help of a robust thermal conductivity cell with a wide measuring range. This cell was optimized for integration into the ELEMENTRAC ONH analyzers and permits the use of cost-efficient argon as carrier gas.

Thermal conductivity cell with high sensitivity



The innovative ELEMENTRAC thermal conductivity cell is based on a micromechanical silicon chip which is coupled to a membrane and works independently of a reference gas flow. If the thermal conductivity of the gas changes, for example through nitrogen released from the sample, the heating capacity required for heating the membrane changes as well. This is indicated by a measuring signal. The method is robust and sensitive and it guarantees stable measuring results over a wide concentration range.

Argon as carrier gas

For nitrogen analysis helium is usually the standard carrier gas. Argon, however, is often easier to obtain and more cost-efficient which makes its use more economic than that of helium. Thanks to its extraordinary stability and sensitivity the new ELTRA thermal conductivity cell dissolves minor differences in the thermal conductivity of nitrogen and argon and produces accurate measurement results. Even nitrogen concentrations as low as 20 ppm in steel are reliably and accurately detected.

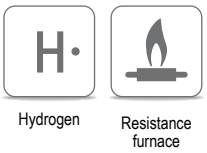
	M [g/mol]	Density [kg/m³]	Coefficient of thermal conductivity [W/kW][1]
Hydrogen H_2	2.02	0.08987	1.869
Helium He	4.00	0.17839	1.567
Nitrogen N_2	28.01	1.2505	0.260
Argon Ar	39.94	1.7839	0.179

[1] CRC Handbook of Chemistry and Physics, 1995-1996, 76th Edition

Beside helium and nitrogen argon is also a standard carrier gas for the ELEMENTRAC ONH analyzers. They are equipped with connections for all three gasses so that no cumbersome hardware modifications are required.

Hydrogen Analyzer

H-500



Precise determination of H_2 also in large samples

Benefits

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

For the determination of the total hydrogen content in inorganic sample materials by inert gas fusion both ELEMENTRAC OH-p and ELEMENTRAC ONH-p are suitable. Another option is ELTRA's H-500 analyzer which measures hydrogen by hot extraction in a quartz tube.

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 in the low ppm range are measured accurately and reliably.

Typical sample materials

Steel, iron, copper, weld seams and many more

Hydrogen analyzer H-500

Operation H-500

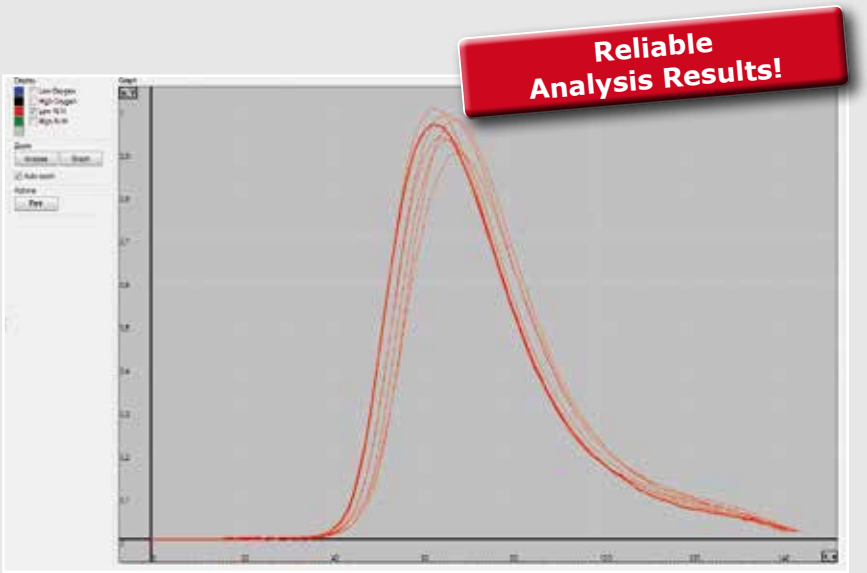
Operation of the H-500 is easy and safe. After weighing the sample, for example in a quartz boat, the weight is transferred to the connected PC. It is also possible to enter the weight manually in the H-500 software. The sample is placed into the cold zone of the horizontally positioned furnace (fig. 1). After the analysis has started 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 to a thermal conductivity cell with up to two different sensitivities. 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

Only a resistance furnace with quartz tube is suitable to determine the content of diffusible and residual hydrogen in a steel sample, due to the required temperature of up to 1,000 °C and the sample length of several centimeters (for 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

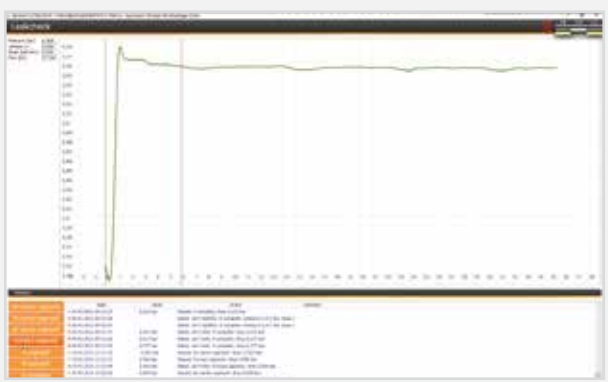
PC control with Windows®-based software

The ELEMENTS software used in the ELEMENTRAC ONH series ensures rapid, reliable and user-friendly operation of the analyzers. A special focus was placed on diagnosis and application tools.

The structure of the ELEMENTS software is based on a single central window (analysis) from which all important functions such as calibration, sample log in and analysis, evaluation etc. can be started. Further functionalities such as maintenance, application settings etc. are only one mouse click away from the central window. This arrangement permits an efficient and convenient working process.

The following functions are implemented in the ELEMENTS software:

- Creation and dissolution of „groups"
- Report function for analysis data and calibrations
- Export functions
- One point or multi point calibration (linear regression)
- Calculation and recalculation of measurement values
- Comment fields
- Wide selection of application settings ensures reliable measurements
- User-defined maintenance counter
- Automated segmented leakage test



Leakage test

The analyzers of the ELEMENTRAC ONH series have been designed with a closed gas system, hence the possibility to carry out a leakage test is essential.
The integrated software-based leakage test runs a fully automated test on all areas (e. g. furnace, measurement cells) of the ONH analyzers.

ELTRA's ELEMENTRAC ONH series fulfills the requirements of all relevant standards

Oxygen, nitrogen and hydrogen determination according to ASTM standard

Standard	Sample material	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

Oxygen, nitrogen and hydrogen determination according to ISO standard

Standard	Sample material	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 – Method with infrared absorption
3690	Welding seams (steel and iron)	Welding and allied processes – Determination of hydrogen content in arc weld metal

The oxygen, nitrogen and hydrogen concentrations of inorganic sample materials can be quickly and reliably measured in the impulse furnaces of the ELEMENTRAC ONH analyzers.

Typical sample materials

Steel, copper, titanium, lead, ores, ceramics (e. g. boron nitrite)

Example:

Oxygen, nitrogen and hydrogen in steel

The oxygen, nitrogen and hydrogen content have a strong influence on material properties such as hardness, ductility or brittleness of steel. Therefore, the determination of these parameters is an essential part of the quality control of steel. The ELEMENTRAC ONH analyzers fulfill all requirements of standards like ISO 10720 and 17053. Thanks to the innovative sample port system it is possible to analyze grains without capsule (e. g. CRM 281-1).

Typical measurement results

Sample weight approx. 1,000 mg (ELTRA samples), 500 mg (CRM 281-1), 10 measurements

Reference material	Oxygen [ppm]	Nitrogen [ppm]	Hydrogen [ppm]
ELTRA 91100-1001	6.0 ± 0.6	18.5 ± 0.6	*
EURO CRM 281-1	108.7 ± 5.2	232 ± 8.1	*
ELTRA 91400-1003	*	*	6.0 ± 0.3

* not certified

Example:

Oxygen in copper

Oxygen is introduced into copper during production and when tubes or wires are drawn. Therefore measuring the oxygen content is part of an effective quality control process and can be conveniently carried out with the ELEMENTRAC ONH analyzers.

Typical measurement results

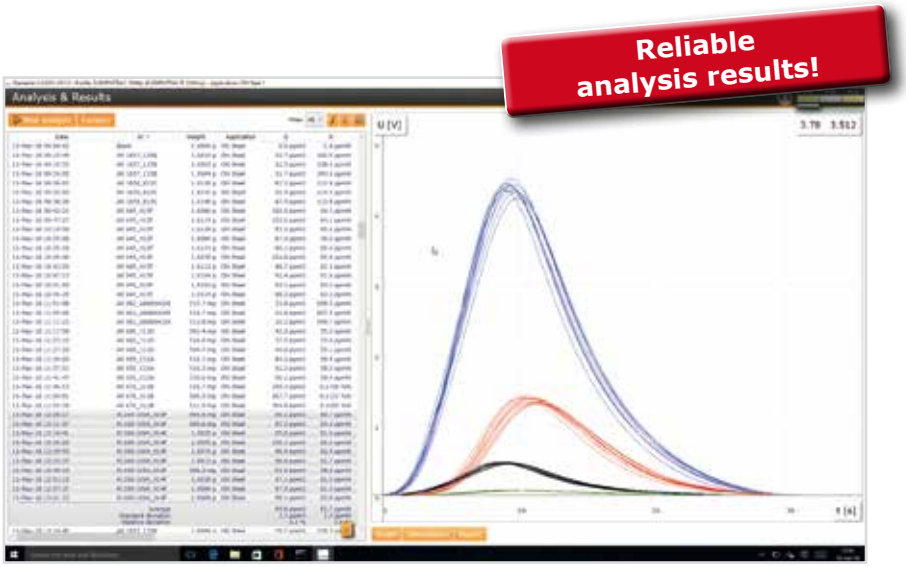
Sample weight approx. 1,000 mg, 10 measurements

Reference material	Oxygen [ppm]
ELTRA 91000-1004 (Lot 113C)	7.0 ±0.6

Example:

Oxygen, nitrogen and hydrogen in titanium

An accurate element analysis of titanium is challenging because of its high melting point. Therefore, a power of 6 kW is required for oxygen and nitrogen analysis whereas 3 kW are sufficient for hydrogen analysis.



Typical measurement results

Sample weights approx. 100 mg, 10 measurements

Reference material	Oxygen [%]	Nitrogen [%]	Hydrogen [ppm]
ELTRA 912505-1004 (Lot 613B)	0.215 ±0.008	0.0065 ±0.0012	77 ±8
ELTRA 912505-1001 (Lot 114C)	0.0522 ±0.0013	0.0101 ±0.0009	11 ±0.9

Technical Data

	ONH Analyzers ELEMENTRAC® ON-*p* | OH-*p* | ONH-*p*	**Hydrogen Analyzer** H-500
Measuring ranges	**1 g sample**	**1 g sample**
Oxygen	0.1 ppm – 2 %[1]	–
Nitrogen	0.1 ppm – 2 %	–
Hydrogen	0.01 ppm – 1,000 ppm	0.01 ppm – 1,000 ppm
Analysis time		
Oxygen	85 seconds	–
Nitrogen	90 seconds	–
Hydrogen	100 seconds	3 – 15 minutes
General data		
Sample weight (nominal)	1 g	1 g
Calibration	Solid standards (one point; multi point), gas calibration	Solid standards (one point; multi point), gas calibration
Detection	Non-dispersive IR (O_2); Thermal conductivity cell (N_2; H_2)	Thermal conductivity cell
Chemicals	Magnesium perchlorate; sodium hydroxide on inert carrier; copper oxide; Schuetze reagent	Magnesium perchlorate; sodium hydroxide on inert carrier; Schuetze reagent
Required gas	Helium, nitrogen (99.995 %, 2 – 4 bar); compressed air (oil- and water-free), 2 bar	Nitrogen (99.995 %, 2 – 4 bar)
Optional carrier gas	Argon (99.995 %, 2 – 4 bar)	–
Nominal gas flow	19 – 27 L/h	10 – 15 L/h
Furnace	Water-cooled impulse furnace with 8.5 kW[2]	Resistance furnace with quartz tube up to 1,000 °C
Cooling	Heat exchanger (included), alternative use of chiller possible, tap water	–
Working conditions	15 – 35 °C; 20 – 80 % humidity (not condensating)	15 – 35 °C; 20 – 80 % humidity (not condensating)
Power supply	400 V AC ±10 %; 50/60 Hz; 3 phases max. 8,500 W; 1 phase configuration on request	230 V AC ± 10 %; 50/60 Hz; 2.0 A; 450 W
Weight (analyzer only)	161 kg	40 kg
Dimensions (W x H x D)	57 x 77 x 63 cm	75 x 52 x 60 cm

[1] The exact measuring range depends on the selected configuration.
[2] Limited to 6.8 kW in applications

ELTRA®
ELEMENTAL ANALYZERS

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

Phone +49 2104/2333-400
Fax +49 2104/2333-499
E-Mail info@eltra.com
Internet www.eltra.com

part of VERDER scientific

Subject to technical modifications and errors
99000-0002/E-07-2016