ELTRA®
ELEMENTAL ANALYZERS

H

Hydrogen Determination in Steel

with ELEMENTRAC® ONH-*p* series

ELTRA
Excellent measuring results!

ELEMENTRAC® ONH-*p* series

Hydrogen determination in steel with the ELEMENTRAC ONH-*p* series

Hydrogen influences the mechanical properties of steel in a significant way. Due to the risk of hydrogen embrittlement, a precise and reliable determination is recommended particularly for stainless steel products. For comprehensive hydrogen determination ELTRA offers the H-500 and ELEMENTRAC ONH-*p* series.

The resistance furnace of the **H-500** provides temperatures up to 1000 °C and is used for the determination of the diffusible hydrogen content or, in some cases, for the determination of the total hydrogen content through thermal heat extraction.

Resistance furnace

The **ELEMENTRAC ONH-*p* series** uses an electrode furnace at temperatures up to 3000 °C and is available in different configurations. It may be used exclusively for hydrogen measurement or in conjunction with oxygen and nitrogen measurement by inert gas fusion.

Impulse furnace

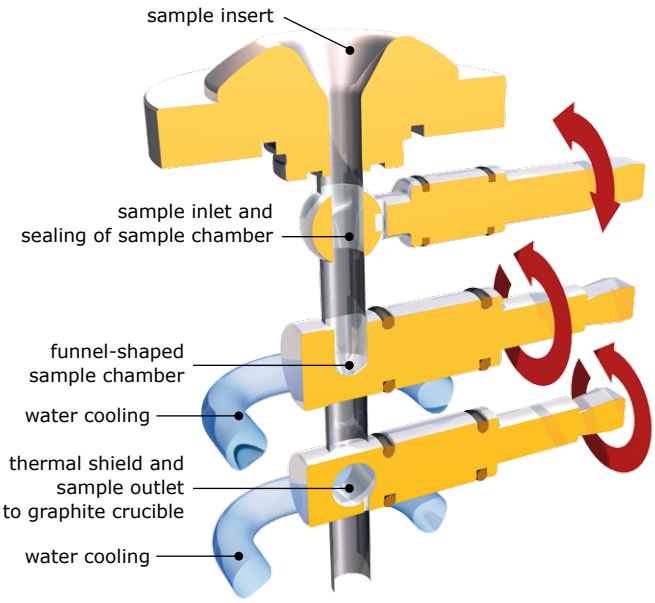
The ELEMENTRAC ONH-p series is perfectly suited for hydrogen determination thanks to the following technical features:

Closed gas system

This gas management system ensures that no analyte is lost during measurement. A reduced carrier gas flow supports maximum sensitivity.

Water-cooled sample port system with additional heat shield

The combination of water cooling and thermal shield in the sample port system makes the ELEMENTRAC analyzers perfectly suited for sensitive hydrogen measurements because the 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.



Sensitive thermal conductivity cell

The innovative thermal conductivity cell provides a sensitive and robust measuring channel and allows reliable hydrogen determination over a wide concentration range.

Please note

For a reliable determination of hydrogen, both sampling and sample preparation are very critical issues which are described in detail in the ASTM standard E 1806-09. With incorrect sampling and processing, the measured hydrogen content may show wide deviations over multiple measurements.

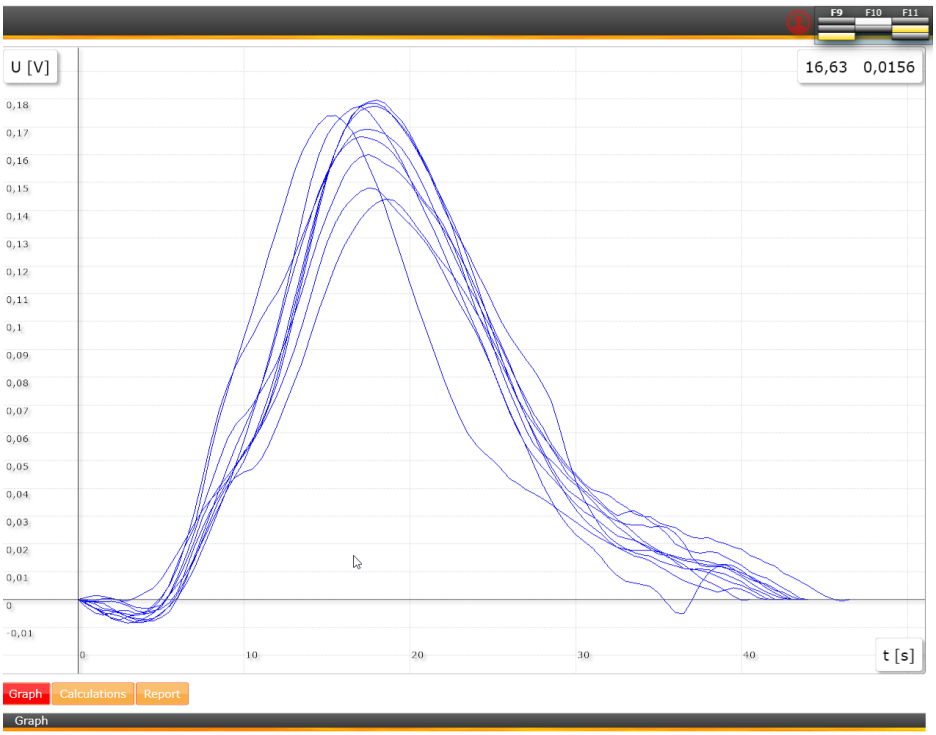
In the following, some exemplary measurements of the ELEMENTRAC ONH-*p* series are shown:

Example 1:

Reference material BAM ZRM H1

Certified value 0.97 ppm H (± 0.1 ppm)

Example 1	
Reference material BAM ZRM H1	
Weight (mg)	**Measured data ppm H**
998.3	0.9
1001.3	0.8
987.8	1.0
986.8	1.0
989.6	1.0
995.7	0.9
987.2	1.0
997.5	1.0
993.1	1.1
995.0	1.0
Mean value	
	1.0
Deviation	
	± 0.1 (6.1 %)

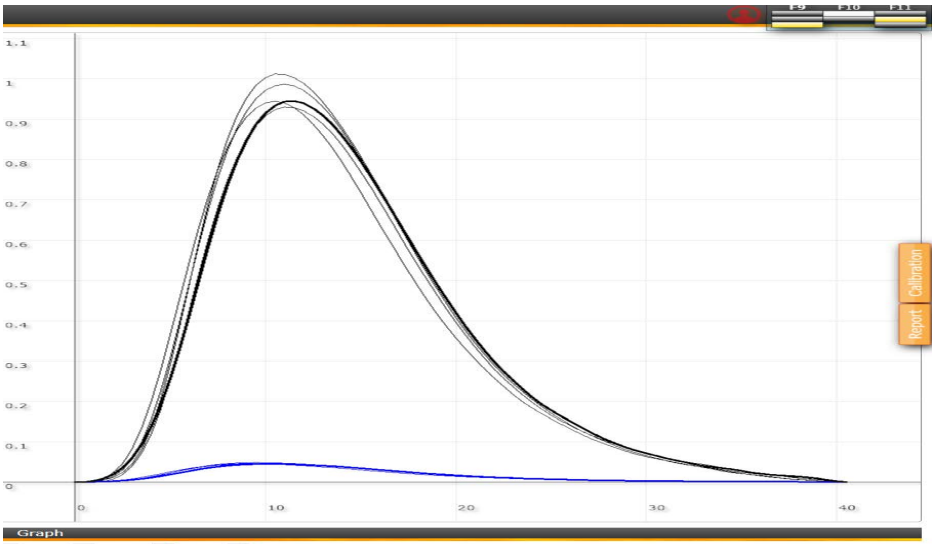


Example 2:

CRM ELTRA 91400-1003 (LOT 812C)

Certified value 6.0 ppm H (±1 ppm)

Example 2	
CRM ELTRA 91400-1003 (LOT 812C)	
Weight (mg)	**Measured data ppm H**
1002.4	6.3
1009.5	5.9
1006.3	5.9
1005.4	6.4
1004.5	6.1
Mean value	
	6.1
Deviation	
	±0.2 (3.6%)

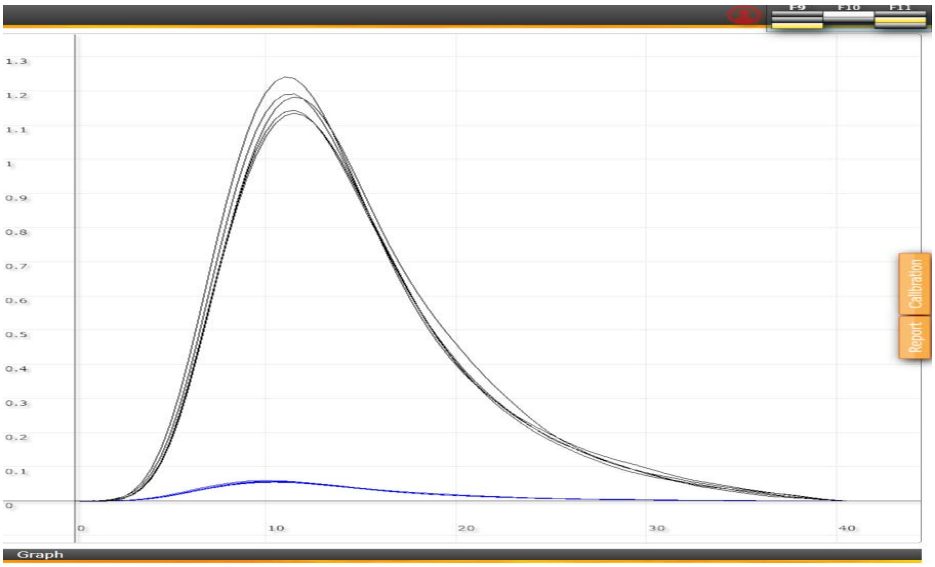


Example 3:

Reference material Alpha Ressources AR 558 (LOT 112904)

Certified value 7.3 ppm H (±0.6 ppm)

Example 3	
Reference material Alpha Ressources AR 558 (LOT 112904)	
Weight (mg)	**Measured data ppm H**
1002.7	7.5
1000.0	7.1
1008.4	7.2
1008.8	7.2
1003.0	7.4
Mean value	
	7.28
Deviation	
	±0.16 (2.2%)



Example 4:

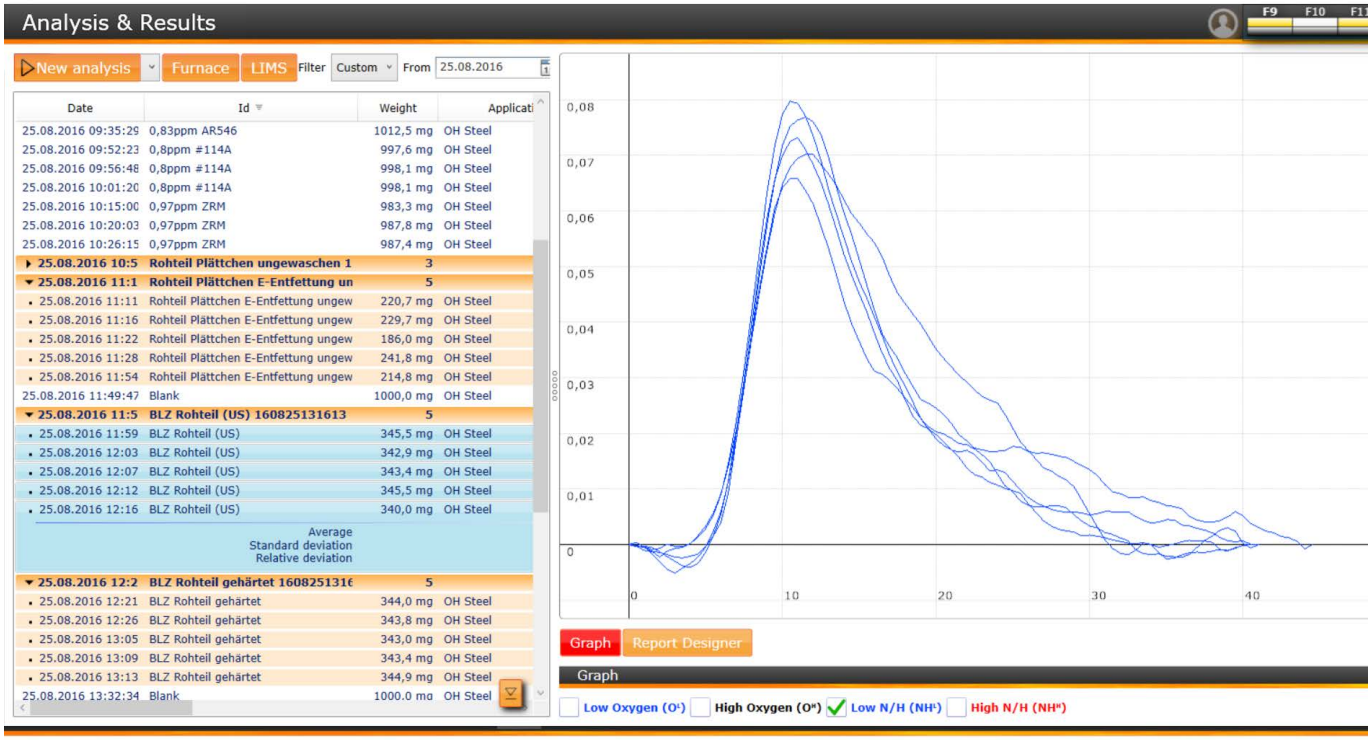
Steel discs used in the automotive industry (customer samples)

Beside steel pins of 1 g, samples with lower weights can be analysed as well:

Example 4a	
uncleaned disc	
Weight (mg)	**Measured data ppm H**
220.7	2.78
229.7	2.92
241.8	2.63
214.8	2.92
186.0	3.83
Mean value	
	3.02
Deviation	
	±0.47 (15%)

Example 4b	
cleaned disc	
Weight (mg)	**Measured data ppm H**
345.5	2.52
342.9	2.43
343.4	2.28
345.5	2.22
340.0	2.57
Mean value	
	2.40
Deviation	
	±0.15 (6%)

Example 4c	
cleaned and hardened disc	
Weight (mg)	**Measured data ppm H**
344.0	1.84
343.8	1.81
343.0	1.99
343.4	2.00
344.9	2.20
Mean value	
	1.97
Deviation	
	±0.16 (8%)



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

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