ELTRA
ELEMENTAL ANALYZERS

OVER
40
YEARS

ELEMENTRAC®

ELEMENTRAC CS-i
ELEMENTRAC CS-d

EXCELLENCE IN ELEMENTAL ANALYSIS

part of **VERDER** scientific

Eltra GmbH in Haan, Germany

ELTRA –
ELEMENTAL ANALYZERS

EXCELLENCE IN ELEMENTAL ANALYSIS

The history of ELTRA GmbH began in 1981 with the development of a carbon / sulfur analyzer for metals. Right from the start customer requirements were a priority, ensuring that ELTRA analyzers are easy to operate, have a long service life and provide reliable and precise measurement data even under harsh conditions, e.g. in a mine or near a blast furnace.

The best proof of our success are thousands of satisfied customers worldwide. They appreciate the reliability and flexibility of our analyzers, the good price-performance ratio of the instruments and consumables as well as the excellent after sales service. ELTRA analyzers are used in numerous industries, such as metal production and processing, aerospace, energy, medical technology, environment, but also in universities and research institutes.

ELTRA has been part of the Verder Group since 2012 and consistently invests in research and development. With the launch of the ELEMENTRAC series with powerful ELEMENTS software, ELTRA offers analyzers for fast and reliable O/N/H and C/S analysis that provide integrated solutions for special requirements in addition to modern design and convenient operation. The proprietary Dual Furnace Technology, for example, allows the analysis of organic and inorganic samples with one single instrument - a concept only offered by ELTRA.

part of **VERDER** scientific

SOLUTIONS FOR C/S ANALYSIS

ELTRA C/S ANALYZER ELEMENTRAC CS-i

For reliable carbon and sulfur analysis in a wide variety of samples such as metals, ceramics or fuels, ELTRA offers two powerful combustion analyzers with IR detection: the ELEMENTRAC CS-i and the ELEMENTRAC CS-d.

The ELEMENTRAC CS-i with a powerful induction furnace is ideally suited for robust analysis of carbon and sulfur in inorganic samples such as iron, steel, cast iron, alloys, glasses or ceramics.

ELTRA C/S ANALYZER ELEMENTRAC CS-d

The ELEMENTRAC CS-d enhances the ELEMENTRAC CS-i with a resistance furnace to additionally analyze organic samples such as wood, plastics, oils, soils for their C/S content.

Sample	Induction furnace	Resistance furnace
Metals: iron, cast, copper, titanium	✔	–
Soil	✖	✔
Cement	✔	✖
Lime	✔	✔
Ore	✔	✔
Coal, coke, wood, oil	–	✔
Plastics	–	✔
Waste	–	✔
Dust and ashes	✔	✖
Carbides (WC;SiC): Total C	✔	–
Free carbon in carbides	–	✔

✔ possible   ✖ possible to a limited extent   – impossible

BENEFITS ELEMENTRAC CS-I

I Rapid C/S analysis (40 seconds)
I Virtually no sample preparation
I Wide measuring range from 1 ppm to 100 % for C and S
I Analysis of pins, wires, powders, dust
I Simple operation

ELEMENTRAC CS-i

C/S ANALYSIS IN INORGANIC MATERIALS VIA INDUCTION FURNACE

STEP 1: LOGGING THE SAMPLE INTO THE ELEMENTS SOFTWARE

The sample ID is logged into the software and the weight is automatically transferred (see step 2).


STEP 2: WEIGHING AND ADDING OF ACCELERATORS

Sample volumes of 50 mg to 1000 mg are typical for C/S analysis. The sample is weighed in a ceramic crucible and accelerators like tungsten are added. The geometry of the sample (e. g. wire, powder, pin etc.) is not essential for a reliable analysis.

ELEMENTRAC CS-i

OPERATION AND ANALYSIS PROCESS

The elemental analyzer ELEMENTRAC CS-i measures the carbon and sulfur concentration in predominantly inorganic samples through combustion in an induction furnace and the subsequent analysis of the gaseous combustion products carbon dioxide and sulfur dioxide.

The high temperature of more than 2000 °C ensures complete decomposition of the sample and thus reliable and accurate elemental analysis over a wide concentration range.

The ELEMENTRAC CS-i meets and exceeds the requirements of all common standards for carbon and sulfur measurement, such as ASTM E1019, DIN EN ISO 9556.

TYPICAL SAMPLE MATERIALS

❚ Steel, iron, cast iron, copper, alloys, ceramics, carbides, soil etc.

STEP 3: ANALYSIS

The ceramic crucible is then placed on the pedestal and the analysis is started via the ELEMENTS software. The software controls all subsequent steps like combustion and evaluation.
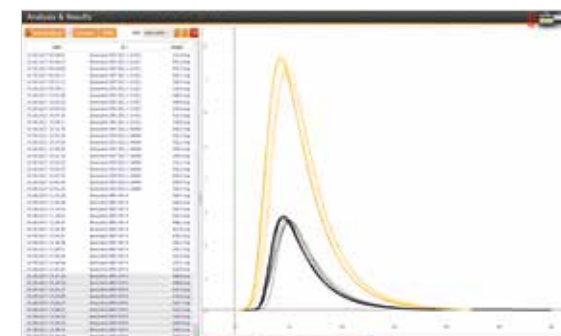
STEP 4: DATA OUTPUT AND EXPORT

45-60 seconds after the analysis has started, the measured carbon and sulfur concentrations are available for export as a report or via LIMS.

BENEFITS ELEMENTRAC CS-d

I Unique combination of induction & resistance furnace

I IR path of massive gold

I Wide C/S measuring range from 2 ppm to 100 %

ELEMENTRAC CS-d

C/S ANALYSIS IN INORGANIC MATERIALS VIA INDUCTION FURNACE & IN ORGANIC MATERIALS VIA RESISTANCE FURNACE

ELEMENTRAC CS-d

OPERATION AND ANALYSIS PROCESS

The ELEMENTRAC CS-d is equipped with a resistance furnace for the combustion of organic materials and an induction furnace for the combustion of inorganic materials.

For reliable carbon and sulfur analysis, the furnaces can be used independently without hardware adjustments. The shared detection unit detects the gaseous combustion products CO_2 and SO_2. It consists of up to four infrared cells with an IR path made of solid gold which ensures a high resistance against. aggressive combustion residues (e.g. halogens). The high temperatures of over 2000 °C in the induction furnace and 1550 °C in the resistance furnace guarantee a complete decomposition of the sample and thus a safe and precise C/S analysis over a wide concentration and sample range.

The ELEMENTRAC CS-d meets or exceeds the requirements of all common standards for carbon and sulfur measurement with combustion analyzers such as ASTM E1019, DIN EN ISO 9556. The use of the induction furnace is analogous to the ELEMENTRAC CS-i. The analysis process via resistance furnace is shown below.

TYPICAL SAMPLE MATERIALS

❚ Induction furnace: steel, iron, cast, copper, titanium, ceramics
❚ Resistance furnace: coal, wood, soil, ore

STEP 1: LOGGING THE SAMPLE INTO THE ELEMENTS SOFTWARE

The sample ID is logged into the software and the weight is automatically transferred (see step 2).

STEP 2: WEIGHING THE SAMPLE

Sample volumes of 50 mg to 500 mg are typical for C/S analysis in a resistance furnace, depending on the material. The sample is directly applied to a boat. Accelerators are usually not required.
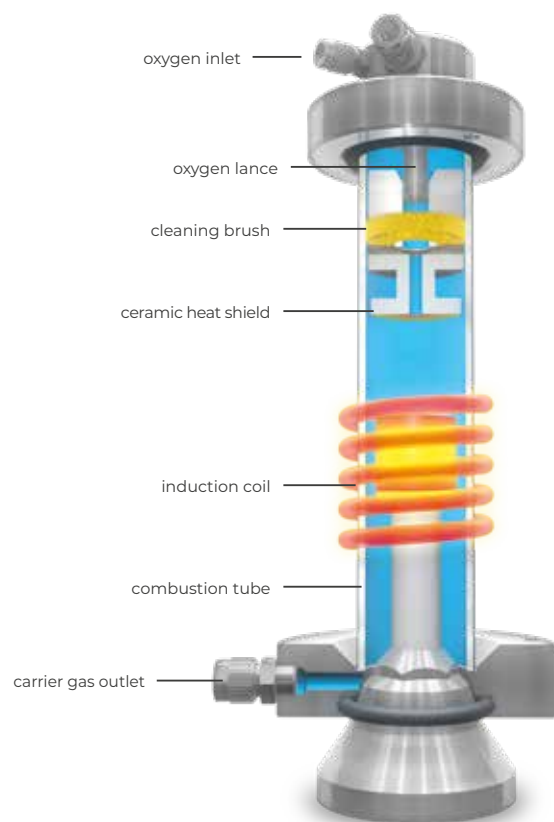

STEP 3: ANALYSIS

The sample is placed in front of the furnace and the measurement is started in the software. A green LED signals when the sample can be introduced to the furnace. During combustion the ELEMENTS software continuously records measurement values.
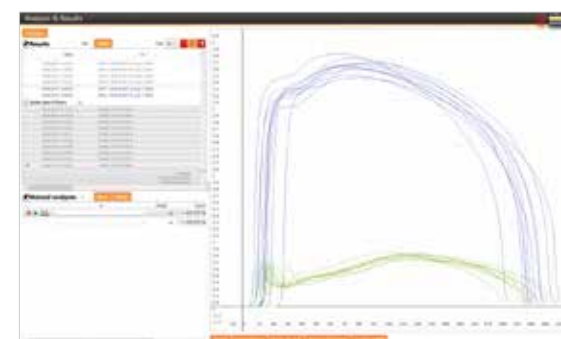
STEP 4: DATA OUTPUT AND EXPORT

60 to 240 seconds after the analysis has started, the measured carbon and sulfur concentrations are available for export as a report or via LIMS.

SOLUTIONS IN DETAIL

OPTIONS

In addition to the integrated features of the ELEMENTRAC CS-d and ELEMENTRAC CS-i, further options are available to increase the efficiency of the carbon / sulfur measurement.

NEW OPTION

130 POSITIONS

TIC MODUL

Carbon can be determined as total carbon (TC) or in fractions, i. e. total organic carbon (TOC) or total inorganic carbon (TIC). When combined with the ELEMENTRAC CS-d or CS-i, ELTRA's TIC module measures the TIC content by acidification in products like soil or construction materials.

AUTOLOADER

The induction furnace of the ELEMENTRAC CS-i/CS-d can be equipped with an optional automatic sample loader. The standard module offers 36 crucible positions, the XL model even features 130 positions. It is the largest Autoloader available in the market for this type of application.

SOLUTIONS IN DETAIL

SPECIAL CONFIGURATIONS OF THE ELEMENTRAC CS SERIES

With a broad customer base, ELTRA also has experience in the configuration of analyzers for special applications, such as sulfur analysis of sulfidic ores with very high sulfur content, or C/S analysis of halogen-containing salts.

VERSIONS WITH HALOGEN TRAP OR CEMENT CONFIGURATION

Some samples release more water during inductive combustion; in case of higher sample volumes this may lead to lower results for sulfur determination, since SO_2 is absorbed by the water vapor. An enlarged anhydron trap instead of a metal filter therefore offers greater reliability for sulfur measurements in building materials and ores, since larger amounts of water vapor can be filtered out.

Carbon and sulfur analysis in samples containing halogens such as KBr, K_2TaF_7 can lead to massive corrosion in the analyzer. An optional halogen trap (image on the left) absorbs the corrosive halogens released during combustion, thus extending the maintenance intervals of the ELEMENTRAC CS-i or CS-d.

gas outlet

gas inlet

I_1

I_0
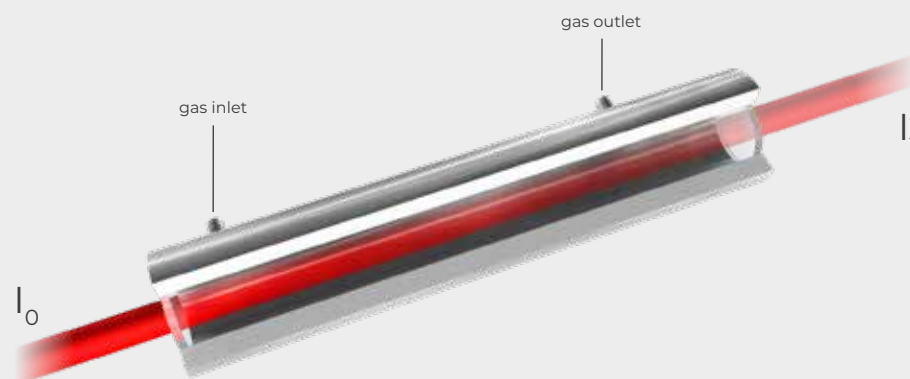
SOLUTIONS FOR AN EXTENDED MEASURING RANGE

Products with a high sulfur content, such as ZnS or copper concentrates, can often only be measured with a reduced sample weight, as otherwise the measuring cells would be saturated due to the high sulfur content.

For these special applications, the analyzers of the ELEMENTRAC series can be equipped with more robust infrared measuring cells for carbon and / or sulfur analysis to extend the measuring range and thus improve the reproducibility of the results.

ELEMENTRAC CS-i AND CS-d

STANDARD-COMPLIANT OPERATION

Regardless of the ELEMENTRAC CS-i or CS-d version, both analyzers meet the requirements of the relevant standards such as ASTM and/or DINENISO.

The following standards are supported (among others):

ISO

No.	Name
15349-2	Unalloyed steel – determination of low carbon content
7526	Nickel, ferronickel and nickel alloys – determination of carbon content
4935	Steel and iron – determination of sulfur content
13902	Steel and iron – determination of high sulfur content
4689-3	Iron ores – determination of sulfur content

ASTM INTERNATIONAL Standards Worldwide

No.	Name
E-1019	Standard test method for determination of carbon and sulfur (...) in steel, iron, nickel and cobalt alloys
E-1587	Standard test methods for chemical analysis of refined nickel
E-1941	Standard test method for determination of carbon in refractaroy and reactive metals
E-1915	Standard test methods for analysis of metal bearing ores and related materials for carbon, sulfur

DIN EN ISO

No.	Name
15936	Sludge, treated biowaste , soil and waste, determination of total organic carbon by dry combustion
1744-1	Tests for chemical properties of aggregates (sulfur measurement)
15350	Steel and iron – determination of total carbon and sulfur content
10694	Soil quality – determination of organic and total carbon after dry combustion
9556	Steel and iron determination of total carbon content

ELTRA'S APPLICATION LABORATORY

For many common samples, such as copper and ceramics, no standards for carbon and/or sulfur analysis by combustion analysis and IR detection are published. To guarantee a safe and reliable measurement, the ELTRA laboratory in Haan is available for application consulting and free sample measurement with all ELTRA analyzers.

Participation in round robin tests (e.g. ASTM Powder Metallurgy) and participation in the certification of reference materials (e.g.: ECRM 268-1; ECRM 049-1) ensure a constantly high analysis quality.

ELEMENTAL ANALYZERS
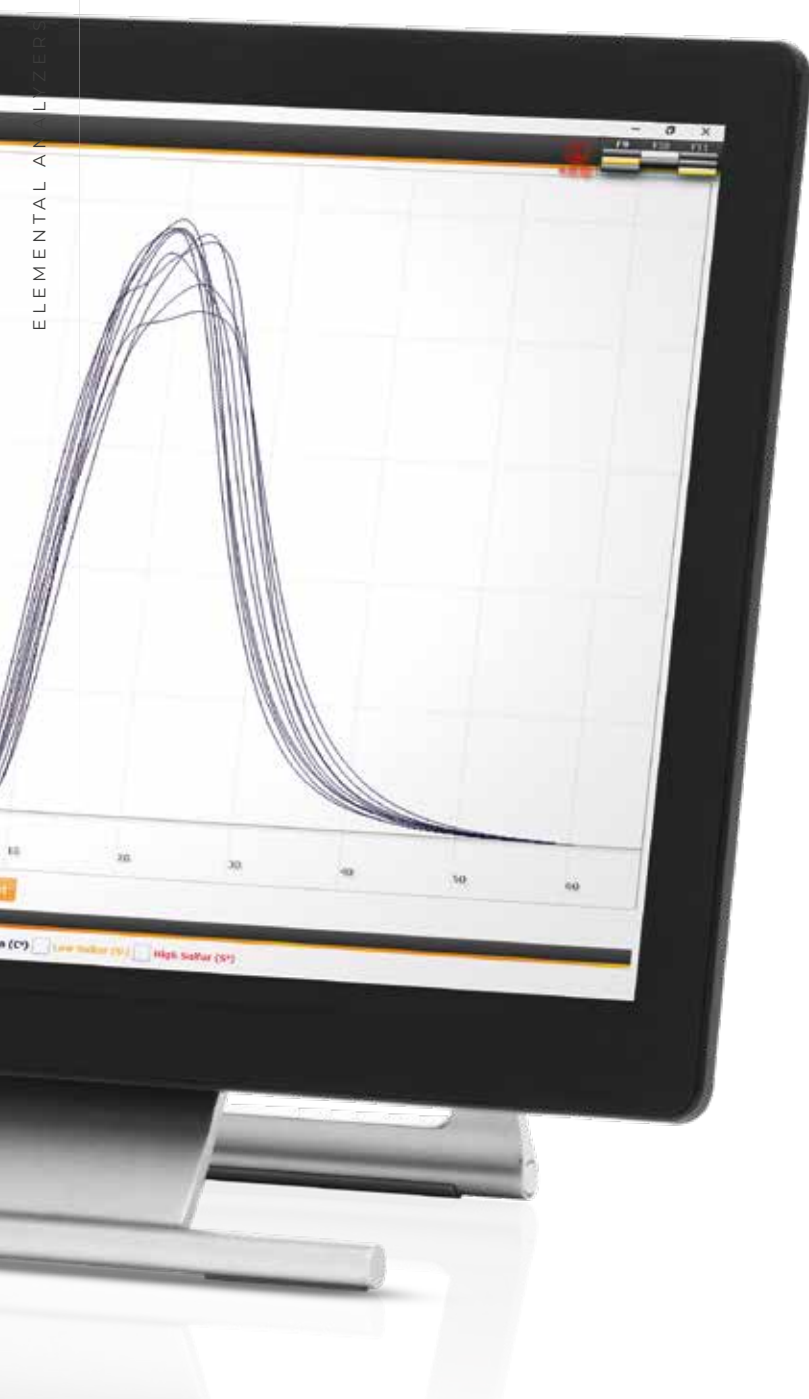
ELEMENTRAC CS-i AND CS-d

THE ELEMENTS SOFTWARE

The C/S analyzers of the ELEMENTRAC series are controlled by the innovative ELEMENTS software. All essential functions are located in the main window (analyses and results), while less important functions such as application settings or instrument status can be used in other windows. Control and switching of windows is done by PC mouse or function keys.

Clear display of measured samples and samples to be analyzed, analysis graphs and calibration functions in one window
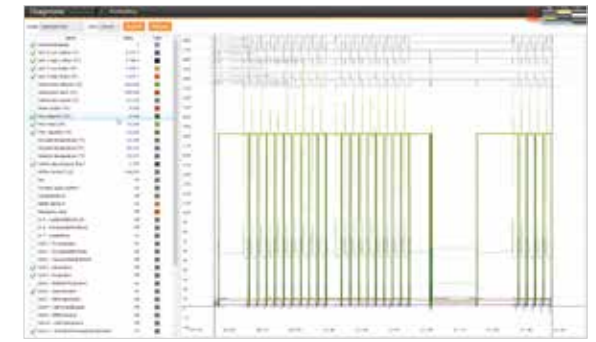
Comprehensive diagnosis screen for monitoring all relevant technical parameters

Clear representation of regression line and the measurement data used

Leakage test for monitoring the correct operation of the analyzer. Segmented evaluation is supported
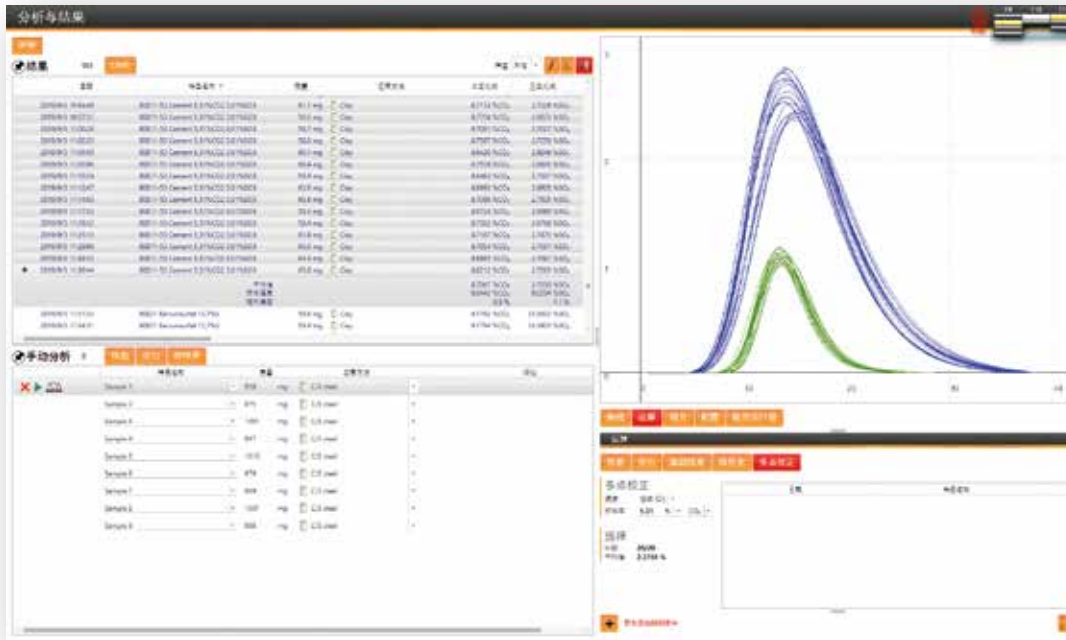
ELEMENTS SOFTWARE

SELECTED FUNCTIONS

The ELEMENTS software is characterized by quick usability, a clear structure and high security. Special strengths include reporting options and adaptation to different languages.
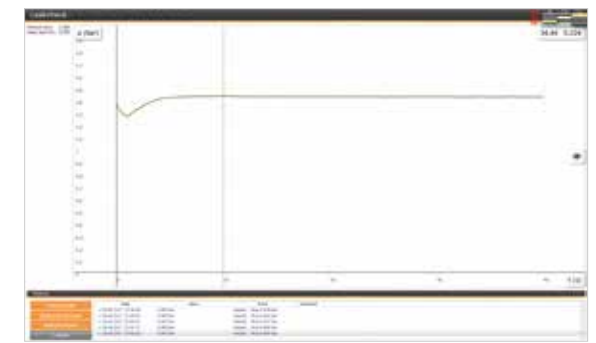
THE ELEMENTS SOLUTION FOR DIFFERENT LANGUAGES

Operating a software in a foreign language can lead to errors, especially under hectic conditions. The ELEMENTS software delivery scope includes different languages, but can also be adapted to the local language any time via an external text file.

ELEMENTS REPORT DESIGNER

The Report Designer interface allows convenient editing of tables, as well as adding images and diagrams.
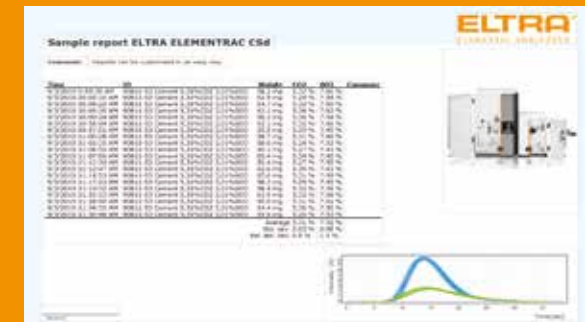
Measured values can also be given as CO_2, SO_3 or SO_4 values, as well as with and without statistics. All elements can be freely arranged on the surface.
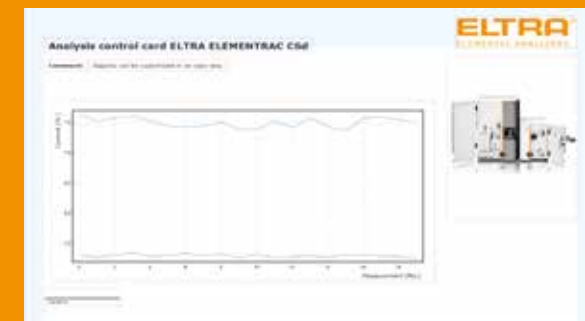
The Report Designer can also be used to create control charts to help identify drift and outliers.

APPLICATIONS

ELEMENTRAC CS-i/CS-d

For the ELEMENTRAC C/S series, ELTRA offers a comprehensive collection of application instructions, which provides the specific analysis steps, instrument settings and measurement data for each sample to be analyzed.

C/S ANALYSIS IN STEEL

| Weight (mg)	Carbon (%)	Sulfur (%)
500.2	0.2038	0.0297
502.2	0.2044	0.0298
501.5	0.2045	0.0297
498.3	0.2029	0.0302
501.9	0.2015	0.0303
505.5	0.2035	0.0300
505.2	0.2035	0.0302
502.1	0.2031	0.0304
501.8	0.2038	0.0302
502.9	0.2050	0.0302
Mean value	0.2036	0.0301
Deviation	0.0010	0.0003
Rel. deviation	0.5%	0.9%

Sample	Sulfur	X-axis
ECRM 187-2	Yellow Peak	Analysis time (sec)
	Carbon	Y-axis
	Black Peak	Intensity (V)

Accelerator — 1.7 g Tungsten
Sample weight — 500 – 1000 mg
Analysis time — 30 – 50 seconds
ELTRA application instruction — 1030

C/S ANALYIS IN COPPER

Weight (mg)	Carbon (ppm)	Sulfur (ppm)
1071.1	18.71	30.35
1112.7	19.48	30.69
1124.3	15.64	28.77
1082.7	16.62	31.02
991.8	18.11	29.01
1133.2	13.74	28.93
1011.5	18.59	28.53
1086.7	20.06	29.37
1083.7	15.00	29.55
1071.8	16.19	28.32
Mean value	17.21	29.45
Deviation	2.08	0.94
Rel. deviation	12.09 %	3.18 %
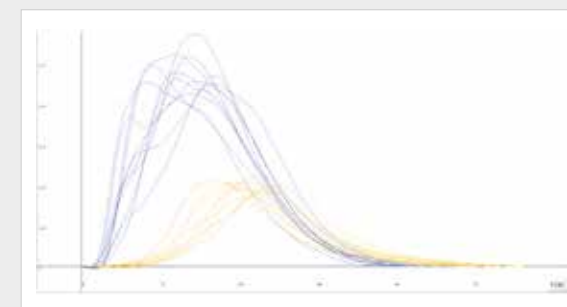
Sample	Sulfur	X-axis
IARM 158 B	Yellow Peak	Analysis time (sec)
	Carbon	Y-axis
	Blue Peak	Intensity (V)

Accelerator — 1 g copper
Sample weight — 500 – 2000 mg
Analysis time — 40 – 50 seconds
ELTRA application instruction — 1037

APPLICATIONS

ELEMENTRAC CS-i/CS-d

For the ELEMENTRAC C/S series, ELTRA offers a comprehensive collection of application instructions, which provides the specific analysis steps, instrument settings and measurement data for each sample to be analyzed.
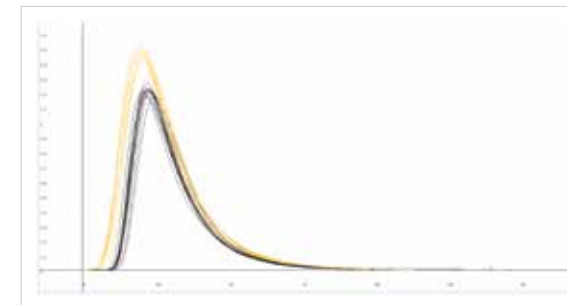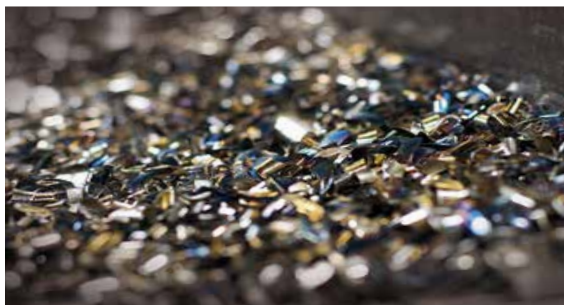

C ANALYSIS IN TUNGSTEN CARBIDE

Accelerator	1 g copper, 1 g iron
Sample weight	50 – 300 mg
Analysis time	40 – 50 seconds
ELTRA application instruction	1033

Weight (mg)	Carbon (%)
257.7	6.1299
258.7	6.1206
264.7	6.1292
254.9	6.1270
261.8	6.1319
255.1	6.1288
261.8	6.1258
265.2	6.1378
256.2	6.1375
250.3	6.1310
Mean value	6.1300
Deviation	0.0051
Rel. deviation	0.1 %

Sample	**Carbon**	**X-axis**
ELTRA 90816-3001 (914C)	Black Peak	Analysis time (sec)
		Y-axis
		Intensity (V)

S ANALYSIS IN SODA GLASS

Accelerator	0.7 g iron, 1.7 g tungsten carbide
Sample weight	100 – 150 mg
Analysis time	30 – 50 seconds
ELTRA application instruction	1039

Weight (mg)	SO_3 (%)
103.5	0.176
103.6	0.175
103.6	0.173
104.3	0.170
102.5	0.166
99.3	0.169
98.3	0.170
102.8	0.166
100.1	0.164
100.8	0.166
Mean value	0.170
Deviation	0.004
Rel. deviation	2.3 %
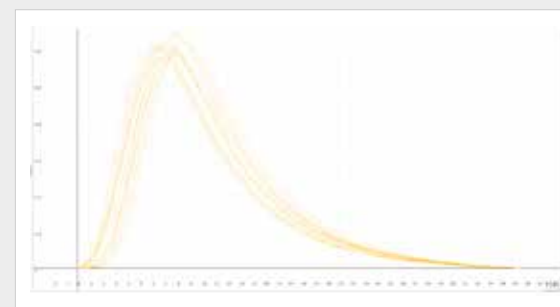
Sample	**Sulfur**	**X-axis**
NCS DC 61103	Yellow Peak	Analysis time (sec)
		Y-axis
		Intensity (V)

APPLICATIONS

ELEMENTRAC CS-d

In addition to the induction furnace, the ELEMENTRAC CS-d also uses a resistance furnace which is more suitable for the analysis of organic products. In contrast to the induction furnace, no additives (such as tungsten) are required for measurements in the resistance furnace.

C/S ANALYSIS IN COAL

Furnace	Resistance, 1350° C
Sample weight	150 – 350 mg
Analysis time	120 – 240 seconds
ELTRA application instruction	1059

Weight (mg)	Carbon (%)	Sulfur (%)
351.6	61.24	6.18
350.0	61.48	5.93
349.2	60.68	6.14
360.0	60.69	6.16
355.8	61.42	6.21
360.1	59.95	6.19
342.1	59.78	6.22
372.0	60.10	6.22
348.2	60.7	6.26
365.2	60.45	6.24
Mean value	60.65	6.18
Deviation	0.59	0.09
Rel. deviation	1.0 %	1.5 %
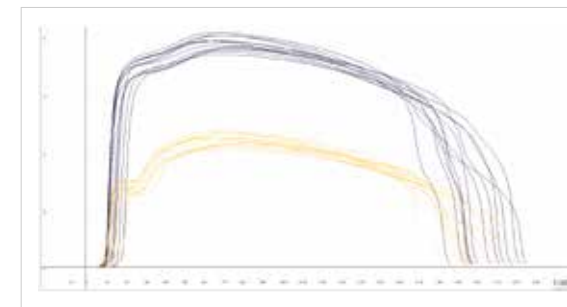
Sample	Sulfur	X-axis
ELTRA 92511-3030(705114)	Yellow Peak	Analysis time (sec)
	Carbon	Y-axis
	Black Peak	Intensity (V)

C/S ANALYSIS IN LIME

Furnace	Resistance, 1450° C
Sample weight	150 – 300 mg
Analysis time	200 – 300 seconds
ELTRA application instruction	1061

Weight (mg)	Carbon (%)	Sulfur (%)
258.6	11.6	0.44
252.6	11.6	0.43
271.6	11.6	0.43
269.5	11.9	0.41
280.6	11.6	0.42
251.7	11.6	0.40
269.7	11.6	0.40
275.7	11.7	0.40
273.2	11.7	0.40
289.7	11.7	0.40
Mean value	11.70	0.41
Deviation	0.09	0.01
Rel. deviation	0.8 %	3.4 %

Sample	Sulfur	X-axis
ELTRA 90812-3002(101602)	Green Peak	Analysis time (sec)
	Carbon	Y-axis
	Blue Peak	Intensity (V)

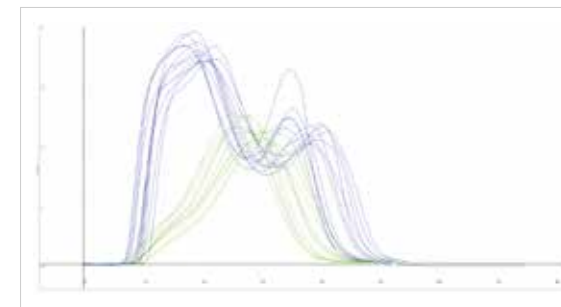## APPLICATIONS

ELEMENTRAC CS-d

In addition to the induction furnace, the ELEMENTRAC CS-d also uses a resistance furnace which is more suitable for the analysis of organic products. In contrast to the induction furnace, no additives (such as tungsten) are required for measurements in the resistance furnace.

Weight (mg)	Carbon (%)	Sulfur (%)
256.1	0.48	0.43
253.2	0.48	0.42
250.7	0.51	0.44
259.6	0.50	0.44
260.0	0.50	0.43
258.1	0.50	0.44
263.3	0.49	0.43
260.4	0.49	0.43
263.7	0.50	0.45
257.1	0.51	0.45
Mean value	0.50	0.44
Deviation	0.008	0.009
Rel. deviation	1.7 %	2.2 %

Sample	**Sulfur**	**X-axis**
AR 4017 (313b)	Green Peak	Analysis time (sec)
	Carbon	**Y-axis**
	Blue Peak	Intensity (V)

C/S ANALYSIS IN SOIL

Furnace	Resistance, 1350° C
Sample weight	60 – 300 mg
Analysis time	60 – 300 seconds
ELTRA application instruction	1063

Weight (mg)	Carbon (%)	Sulfur (%)
353.5	3.80	3.84
356.3	3.81	3.77
381.3	3.80	3.76
373.0	3.73	3.82
366.7	3.75	3.81
356.2	3.64	3.82
352.8	3.73	3.86
369.8	3.75	3.85
357.1	3.74	3.85
363.9	3.70	3.79
Mean value	3.75	3.82
Deviation	0.05	0.05
Rel. deviation	1.4 %	0.9 %
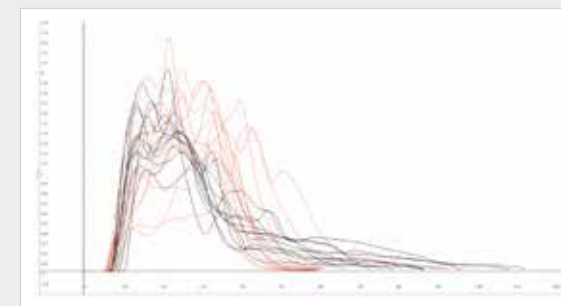
Sample	**Sulfur**	**X-axis**
ELTRA 91900-1002(615D)	Red Peak	Analysis time (sec)
	Carbon	**Y-axis**
	Black Peak	Intensity (V)

C/S ANALYSIS IN ORES

Furnace	Resistance, 1450° C
Sample weight	60 – 500 mg
Analysis time	60 – 300 seconds
ELTRA application instruction	1062

ELTRA®

ELEMENTAL ANALYZERS

Eltra GmbH

Retsch-Allee 1-5
42781 Haan
Germany

Phone: +49 2104 2333-400
Fax: +49 2104 2333-499

info@eltra.com   www.eltra.com

VERDER
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ENABLING PROGRESS.

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As their technology partner behind the scenes, we deliver the solutions they need to make progress and to improve the everyday lives of countless people. Together, we make the world a healthier, safer and more sustainable place.

CARBOLITE GERO 3E-3000°C

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MICROTRAC

ERWEKA