



**ELTRA**<sup>®</sup>  
ELEMENTAL ANALYZERS

# Carbon / Hydrogen / Sulfur Analyzers

CS-580 | CHS-580  
CS-580A | CHS-580A („Helios“)



ELTRA  
Individual  
infrared cell  
configurations  
CHS  
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.**



# Carbon, Hydrogen, Sulfur Analysis

The determination of carbon, hydrogen and sulfur in organic solids and liquids is a routine application in laboratories and production.

ELTRA employs the method of combustion analysis in a resistance furnace for element determination. With a high-capacity ceramic tube temperatures of up to 1,550 °C can be applied, allowing for reliable, precise and reproducible determination even of sulfates in organic samples (such as coal or soil).

The combustion gas is detected in element-specific infrared cells. As a special feature ELTRA offers simultaneous hydrogen analysis – in addition to classical carbon and sulfur analysis – providing the user with even more flexibility for a variety of laboratory applications.

## Carbon / Hydrogen / Sulfur Analysis



### For organic samples

#### CS-580 | CHS-580

04

In the CS-580 | CHS-580 analyzers the sample is weighed in boats and then burnt in a horizontal resistance furnace at temperatures of up to 1,550 °C. The sample is introduced manually into the furnace.



#### CS-580A | CHS-580A („Helios“)

06

In the CS-580A | CHS-580A analyzers the sample is weighed in crucibles and burnt in a vertical resistance furnace at temperatures of up to 1,550 °C. An automatic sample loader feeds the sample to the furnace.

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## ELTRA also provides analyzers for:

### CS inorganic/organic samples



The **CS-2000** is the only analyzer in the market which allows for C and S analysis in both inorganic and organic samples. This is made possible by ELTRA's Dual Furnace Technology (EDF) which combines induction and resistance furnace in one analyzer.

### ONH inorganic samples



The **ONH-2000** is ideally suited for the quick simultaneous determination of oxygen, nitrogen and hydrogen in steel, cast iron, molybdenum, nickel, copper, zirconium, titan, ceramics and other inorganic samples.

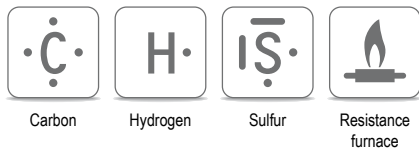
### Thermogravimetry



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

# Carbon / Hydrogen / Sulfur Analyzers

CS-580 | CHS-580



For organic samples!

## Fast and precise element analysis in organic sample materials

### Benefits

- Fast simultaneous determination of CHS
- Powerful horizontal resistance furnace up to 1,550 °C, adjustable in steps of 1 °C
- High sample weights of 500 mg and more possible
- Customizable measuring range
- Individual infrared cell configurations available

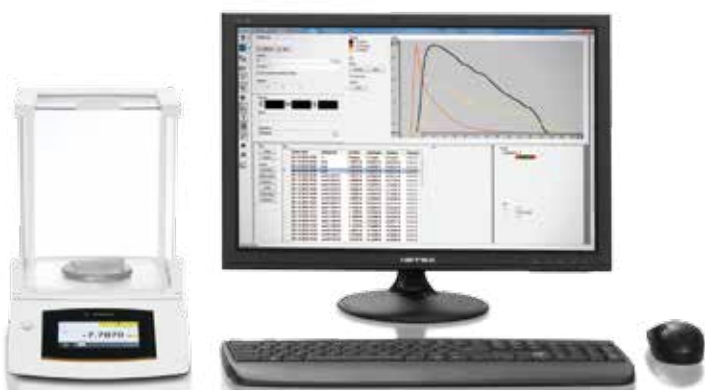
**ELTRA's CHS-580 is the ideal analyzer for the simultaneous determination of carbon, hydrogen and sulfur in organic samples. Thanks to sample weights of 500 mg and more, even inhomogeneous materials can be reliably analyzed. The temperature of the powerful horizontal resistance furnace with ceramic tube can be set in steps from 1 °C to a maximum of 1,550 °C. The analyzer can be equipped with up to four independent infrared cells according to the user's requirements, allowing for a great variety of applications.**

### Typical sample materials

Coal, coke, oil, soil, waste etc.

The ELTRA 580 series features the following models:  
**Analyzers for C, S, CS, CH, HS, CHS**

ELTRA  
Simultaneous  
CHS  
Determination  
CHS  
analyzers



ELTRA CHS-580 analyzer



## Simple and safe operation

After weighing the sample in a ceramic boat, the weight is transferred from the interfaced balance to the PC. If required, sample weights can also be entered manually. Then the ceramic boat is introduced into the furnace for combustion. The average analysis time is 60 to 180 seconds. The 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 CHS-580 requires minimum maintenance. The particle filters and chemicals which need to be maintained are easily accessible.



Weighing in the sample



Manual introduction of the sample into the furnace

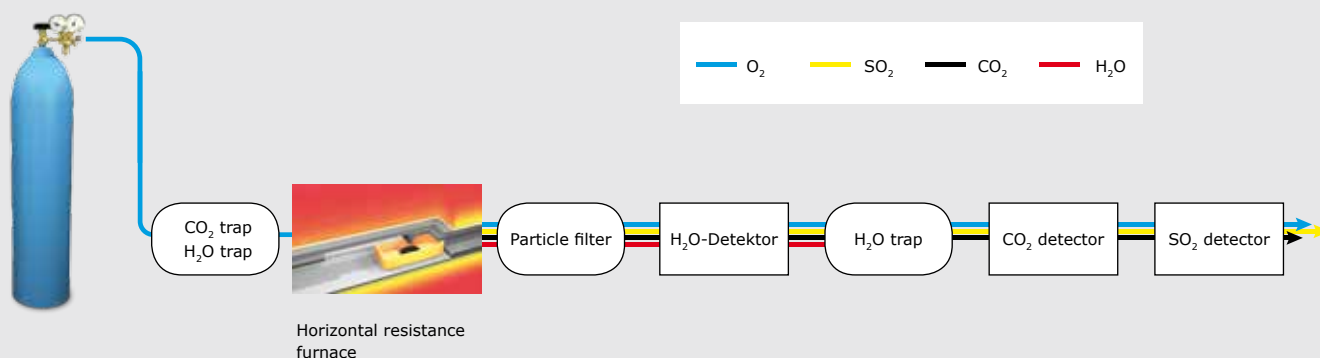


Display of analysis results

## Robust measuring system – easily adaptable to customer requirements

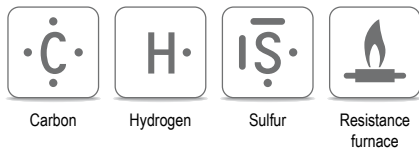
In the CHS-580 the sample is burnt in an oxygen atmosphere at temperatures up to 1,550 °C. The furnace temperature can be freely selected in steps of 1 °C. The combustion gases (CO<sub>2</sub>, H<sub>2</sub>O, SO<sub>2</sub>) coming from the furnace first pass through a dust filter and then into the heated H<sub>2</sub>O infrared cell. After the

water vapor is chemically absorbed, the dried CO<sub>2</sub> and SO<sub>2</sub> gas is detected in the additional infrared cells. Depending on the configuration, it is possible to combine up to four (for CS analyzers) or up to three (for CHS analyzers) infrared cells with different sensitivities.



# Carbon / Hydrogen / Sulfur Analyzers

CS-580A | CHS-580A („Helios“)



For organic samples!

## Fully automatic, user-friendly sample analysis with CS-580A | CHS-580A

### Benefits

- Fully automatic, precise CHS determination with optional sample loader for 36 or 130 crucibles
- Powerful vertical resistance furnace up to 1,550 °C, adjustable in steps of 1 °C
- High sample weights of 500 mg and more possible
- Customer-specific measuring range

**ELTRA's 580A analyzers (A = Autoloader) are equipped with an automatic sample loader, allowing for analysis of large numbers of samples without operator intervention. The sample loader is available in two versions to accommodate 36 or 130 crucibles. The 580A series is based on the technology of the CS-580 | CHS-580 analyzers and features a vertical resistance furnace with ceramic tube. The temperature can be set in steps of 1 °C to a maximum of 1,550 °C. Thanks to sample weights of up to 500 mg and more even inhomogeneous materials can be reliably analyzed. The analyzer can be equipped with up to four independent infrared cells according to the user's requirements, allowing for a great variety of applications.**

### Typical sample materials

Coal, coke, oil, soil, waste etc.

### Reliable, reproducible analyses

In the CS-580A | CHS-580A the samples are weighed into crucibles. Then a gripper places the samples from the Autoloader on the pedestal. The samples are loaded consecutively into the furnace for combustion. The average analysis time is 60 to 180 seconds. Detector signals and instrument parameters are displayed dur-

ing 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 analyzers require minimum maintenance. The particle filters and chemicals which need to be maintained are easily accessible.



Weighing in the sample



Sample feeding with the Autoloader



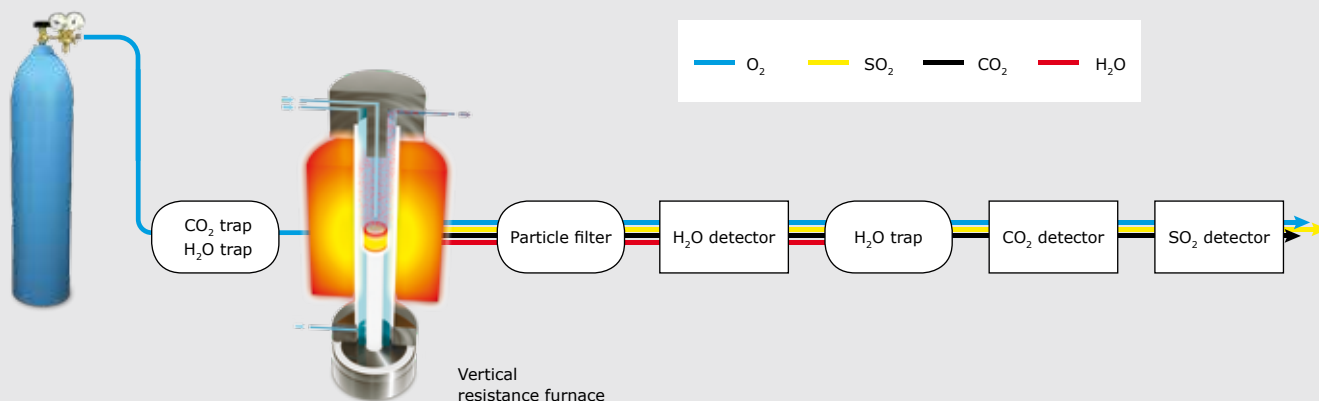
Clearly structured measuring protocols



## Precise and robust measuring system

In the CS-580A | CHS-580A analyzers the sample is burnt in an oxygen atmosphere at temperatures of up to 1,550 °C. The furnace temperature can be freely selected in steps of 1 °C. The combustion gasses (CO<sub>2</sub>, H<sub>2</sub>O, SO<sub>2</sub>) coming from the furnace first pass through a dust filter and then into the heated H<sub>2</sub>O infrared cell. After the water vapor is chemically absorbed, the

dried CO<sub>2</sub> and SO<sub>2</sub> gas is detected in the additional infrared cells. Depending on the configuration, it is possible to combine up to four (for CS analyzers) or up to three (for CHS analyzers) infrared cells with different sensitivities.



## High-performance accessories for ELTRA analyzers

A comprehensive range of instrument add-ons allows for adapting ELTRA analyzers to a variety of laboratory applications. The CS-580A | CHS-580A can be equipped with two different sample loaders for high sample throughput. For the measurement of carbon and sulfur concentrations in the sensitive ppm range ELTRA offers a preheating furnace for boats and crucibles. Another option is the furnace extension for the CHS-580 which is used to reduce CO<sub>2</sub> contamination through ambient atmosphere. A TIC module is available for the determination of total inorganic carbon.

### Autoloader for CS-580A | CHS-580A

#### Benefits

- Perfectly reliable in continuous operation
- Simple assembly of crucibles
- Robust technology

ELTRA's CS-580A | CHS-580A analyzers are designed for operation with an automatic sample loader. It is available with 36 or 130 crucible positions and allows for hours of unsupervised automatic operation. The Autoloader is ergonomically designed and very compact. The combination of a vertical resistance furnace with crucibles provides a robust and fail-safe sample feeding system for automated analyses.

The sample loading system to the vertical furnace is particularly reliable and safe. Damages to the furnace, for example by incorrectly adjusted grippers, are virtually impossible.



Sample loader for 36 samples



Sample loader for 130 samples





## Solutions for low element concentrations



Graphic: Preheating furnace

### Preheating furnace HTF-540

For reliable determination of element concentrations in the sensitive ppm range it is necessary to reduce the blank values of crucibles and boats. For this purpose, the external preheating furnace HTF-540 is available in which the blank values of the sample containers are reduced at a temperature of approximately 1,350 °C.



Preheating furnace HTF-540



### Furnace extension for CHS-580

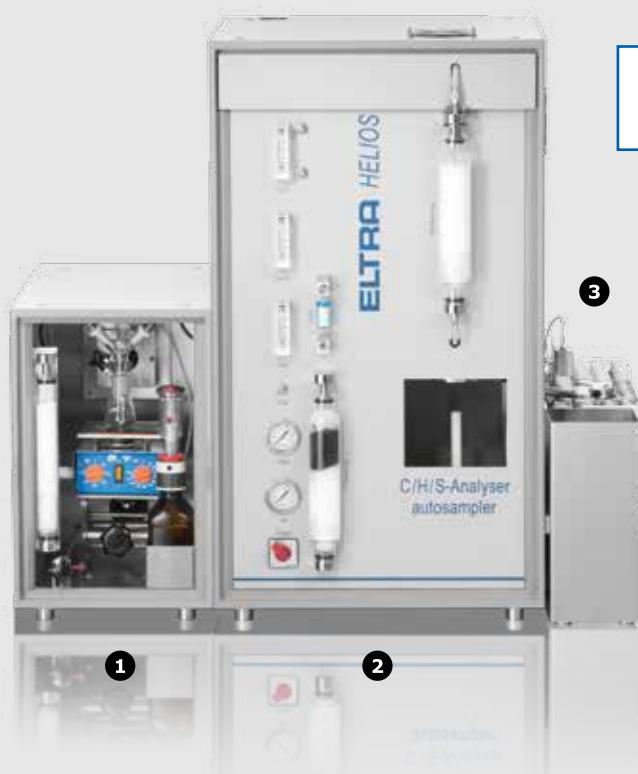
The CHS-580 can be equipped with a furnace extension which reduces the intrusion of atmospheric carbon dioxide due to a reduced tube diameter. As a consequence the blank values are significantly lower.

## TIC module for carbonate analysis

The modular design of ELTRA's analyzers allows for installation of an additional module for the determination of total inorganic carbon. The TIC module can be placed next to the analyzer; modifications of the gas flow system are not required. For TIC analysis the sample is treated with acid in an Erlenmeyer flask inside the TIC module. The infrared cells detect the carbon dioxide released during analysis. The results are displayed by the connected PC.

### Modular system

- 1 TIC module
- 2 CHS-580A
- 3 Sample loader
- 4 Balance
- 5 PC/Software



The TIC module is available for the following models: **CS-580 | CHS-580 and CS-580A | CHS-580A**





Resistance  
furnace

To ensure the complete combustion of organic samples, ELTRA analyzers are equipped with a resistance furnace with ceramic tube. The temperature can be set in steps of 1 °C to a maximum of 1,550 °C which ensures reliable and reproducible determination also of sulfates. ELTRA analyzers are available as C, S, CS, CH, HS or CHS analyzers with individual measuring ranges according to the customer's requirements.

## Up to four independent infrared cells

### Benefits

- Long-term stability
- Low maintenance
- Long service life

The infrared cells used in ELTRA analyzers combine precision with a long service life. 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.

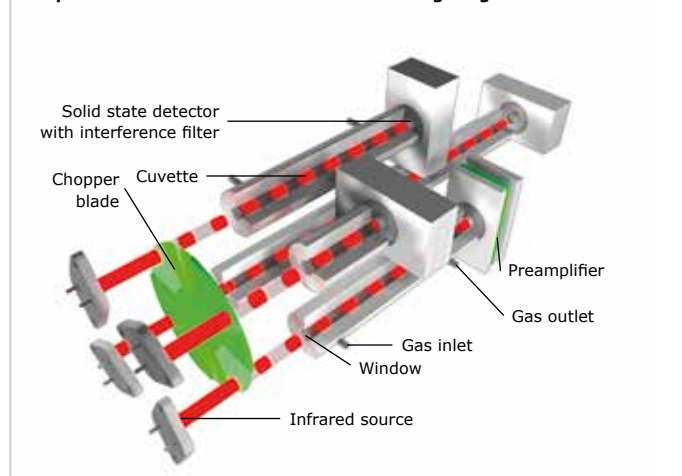
The stability of the baseline, as well as the thermo control of the IR cells is monitored by the software. The analyzers can be supplied with up to four independent IR cells. The length of each cell can be manufactured to give the optimum measuring ranges.



### 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.

Graphic: Infrared cells with flexible measuring range





## Horizontal resistance furnace



The horizontal resistance furnace of the CS-580 | CHS-580 is equipped with a ceramic combustion tube and silicon carbide heating elements. Full electronic control of the furnace ensures maximum service life of the components, including current limitation during heating-up. A sensor monitors ambient temperature and provides data for automatic reference point compensation of the thermo control, ensuring that the furnace temperature remains unaffected by fluctuations of the ambient temperature.

The design of the resistance furnace boat stop forces the oxygen carrier gas to penetrate into the boat, ensuring efficient combustion of the sample. This design eliminates the need to employ fragile lances or honeycomb boat stops which tend to block with dust.

## Vertical resistance furnace in the 580A analyzers

The CS-580A | CHS-580A analyzers also employ a ceramic combustion tube and silicon carbide heating elements for temperatures up to 1,550 °C.

The robust design with automated sample loading and vertical furnace tube ensures particularly effective operation. Due to the vertical design of the resistance furnace sufficient oxygen is blown into the crucible, leading to efficient combustion of the sample. Oxygen enters the furnace via three inlets, one of which is a lance located directly above the crucible. This assembly guarantees a long service life of the ceramic tube.

### Benefits

- Efficient O<sub>2</sub> supply to sample
- Safe, convenient sample loading
- Long service life of ceramic tube



Graphic:  
Vertical resistance furnace





## PC control with Windows®-based software

**ELTRA's instrument software ensures convenient control and operation of the analyzers. 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



*ELTRA's Uni software provides clearly structured analysis protocols*



## ELTRA's CHS analyzers fulfill the requirements of all relevant standards

### ASTM standard compliance with regards to sulfur determination

Standard	Material to be analyzed	Standard title
D-1552	Oil and petroleum	Standard Test Method for Sulfur in Petroleum Products (High-Temperature Method)
D-4239	Coal and coke	Standard Test Method for Sulfur in the Analysis Sample of Coal and Coke Using High-Temperature Tube Furnace Combustion
D-5016	Coal and coke combustion residues	Standard Test Method for Total Sulfur in Coal and Coke Combustion Residues Using a High-Temperature Tube Furnace Combustion Method with Infrared Absorption
D-1619	Carbon black	Standard Test Methods for Carbon Black – Sulfur Content

### ISO and DIN standard compliance with regards to carbon determination

Standard	Material to be analyzed	Standard title
10694	Soil	Soil quality – determination of organic and total carbon after dry combustion (elementary analysis)
DIN EN 13137	Soil	Characterization of waste – Determination of total organic carbon (TOC) in waste, sludge and sediments
ISO 15178	Soil	Determination of total sulfur by dry combustion





With the resistance furnace of the CS-580 | CHS-580 series the carbon, hydrogen and sulfur concentrations in organic samples can be determined quickly and precisely. The maximum temperature of 1,550°C allows for reliable analysis also of sulfates.

### Typical sample materials

**Coal/coke, oil, wood, biomass/refuse-derived fuels, rubber, lime/gypsum, soil, waste**



Example:

## Carbon, hydrogen and sulfur in lignite-coke



For optimum control of flue gas desulfurization the exact determination of the sulfur concentration is essential. The CS-580 | CHS-580 are able to analyze high sample weights (e. g. 200 mg) to compensate for the inhomogeneity of the sample. Thus, even low concentrations (such as in biomass) can be determined precisely and correctly.

This method complies with the standards **ASTM D1552 and ASTM D4239.**

#### Typical results for lignite-coke (CHS-580)

Coke	222.5 mg	87.54% C	0.60% H	0.37% S
Coke	209.9 mg	87.20% C	0.61% H	0.37% S
Coke	205.6 mg	87.19% C	0.59% H	0.37% S
Coke	203.1 mg	87.53% C	0.59% H	0.36% S
Coke	206.5 mg	87.43% C	0.58% H	0.36% S
<b>Mean value:</b>		<b>87.38% C</b>	<b>0.594% H</b>	<b>0.366% S</b>
<b>Standard deviation:</b>		<b>± 0.17</b>	<b>± 0.01</b>	<b>± 0.005</b>

Example:

## Carbon, hydrogen and sulfur in rubber



Small volumes of rubber samples can also be analyzed easily and reproducibly with the CHS-580 for their carbon, hydrogen and sulfur concentrations. For sample preparation, the samples are homogenized to a fineness of 300 microns.

#### Typical results for rubber (CHS-580)

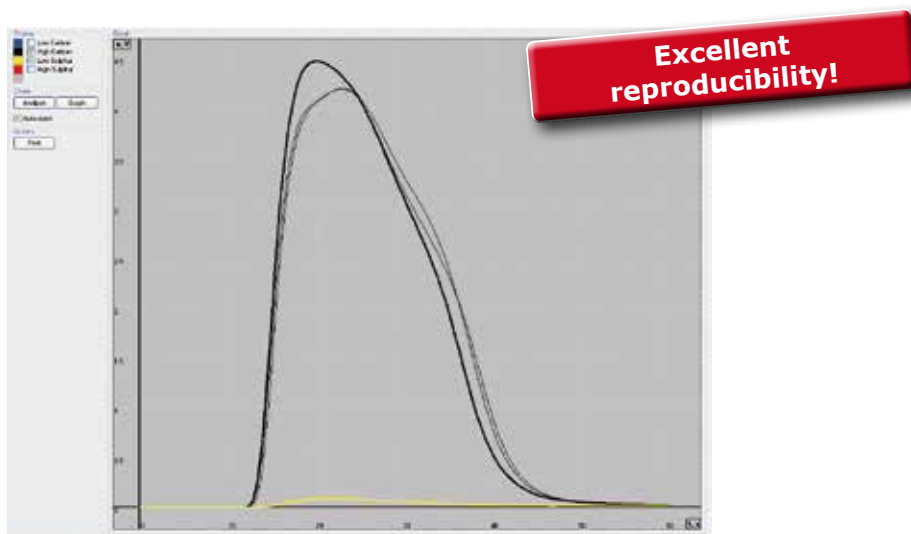
Rubber	40.0 mg	84.16% C	5.88% H	2.15% S
Rubber	44.3 mg	84.02% C	5.76% H	2.12% S
Rubber	43.5 mg	83.40% C	5.77% H	2.14% S
<b>Mean value:</b>		<b>83.86% C</b>	<b>5.80% H</b>	<b>2.13% S</b>
<b>Standard deviation:</b>		<b>± 0.40</b>	<b>± 0.07</b>	<b>± 0.015</b>



Example:

## Carbon and sulfur in biomass

Biomass is usually characterized by low sulfur concentrations. Biomass samples of approx. 200 mg can be analyzed quickly and reproducibly with the CS-580A | CHS-580A analyzers.



Typical results biomass (CS-580A)			
Biomass	214.0 mg	46.85% C	0.018% S
Biomass	210.3 mg	46.99% C	0.017% S
Biomass	214.5 mg	46.95% C	0.017% S
<b>Mean value:</b>		<b>46.93% C</b>	<b>0.0173% S</b>
<b>Standard deviation:</b>		<b>± 0.07</b>	<b>± 0.0006</b>

Example:

## Carbon and sulfur in coal

In the vertical furnace of the CS-580A | CHS-580A analyzers, carbon and sulfur concentrations are analyzed quickly and reproducibly.



Typical results coal (CS-580A)			
Coal	210.3 mg	55.99% C	0.48% S
Coal	203.5 mg	55.99% C	0.49% S
Coal	214.3 mg	55.83% C	0.49% S
Coal	190.2 mg	55.78% C	0.48% S
Coal	186.1 mg	55.67% C	0.49% S
<b>Mean value:</b>		<b>55.85% C</b>	<b>0.486% S</b>
<b>Standard deviation:</b>		<b>± 0.14</b>	<b>± 0.005</b>

# Technical Data

## Carbon / Hydrogen / Sulfur analyzers

CS-580 | CHS-580

CS-580A | CHS-580A („Helios“)

**C, S measurement up to 100%!\***



Measuring ranges <sup>1)</sup>	500 mg sample	500 mg sample
Low carbon measuring range	0.005% – 5% C (25 mg C abs.)	0.005% – 5% C (25 mg C abs.)
High carbon measuring range	5% – 100% C ( 500 mg C abs.)	5% – 100% C ( 500 mg C abs.)
Low sulfur measuring range	0.005% – 2% S (10 mg S abs.)	0.005% – 2% S (10 mg S abs.)
High sulfur measuring range	2% – 20% S (100 mg S abs.)	2% – 20% S (100 mg S abs.)
Hydrogen measuring range <sup>2)</sup>	0.01% – 15% H (75 mg H abs.)	0.01% – 15% H (75 mg H abs.)
Sensitivity	500 mg sample	500 mg sample
Carbon measuring range	10 ppm C (5 µg C)	10 ppm C (5 µg C)
Sulfur measuring range	2 ppm S (1 µg S)	2 ppm S (1 µg S)
Hydrogen measuring range <sup>2)</sup>	100 ppm H (50 µg H)	100 ppm H (50 µg H)
Accuracy <sup>1)</sup>	1 g sample	1 g sample
Low carbon measuring range	±20 ppm C; resp. ±10 µg C or ±1% of carbon content	±20 ppm C; resp. ±10 µg C or ±1% of carbon content
High carbon measuring range	±100 ppm C; resp. ±50 µg C or ±1% of carbon content	±100 ppm C; resp. ±50 µg C or ±1% of carbon content
Low sulfur measuring range	±4 ppm S; resp. ±2 µg S or ±1% of sulfur content	±4 ppm S; resp. ±2 µg S or ±1% of sulfur content
High sulfur measuring range	±100 ppm S; resp. ±50 µg S or ±1% of sulfur content	±100 ppm S; resp. ±50 µg S or ±1% of sulfur content
Hydrogen measuring range <sup>2)</sup>	±200 ppm H; resp. ±100 µg H or ±1% of hydrogen content	±200 ppm H; resp. ±100 µg H or ±1% of hydrogen content
<sup>1)</sup> Depending on sample weight <sup>1)</sup> CS-580: up to 4 infrared cells individually selectable / CHS-580: up to 3 infrared cells <sup>2)</sup> Applies only to analyzers with hydrogen cell		
General data		
Material of IR path	Gold <sup>3)</sup>	Gold <sup>3)</sup>
Standard sample weight	500 mg	500 mg
Analysis time	60 – 180 seconds	60 – 180 seconds
Furnace	Resistance furnace (horizontal) with ceramic tube; adjustable up to 1,550 °C in steps of 1 °C	Resistance furnace (vertical) with ceramic tube; adjustable up to 1,550 °C in steps of 1 °C
Power supply	230 V AC ±10%; 50/60 Hz; 2,000 W maximum heating capacity	230 V AC ±10%; 50/60 Hz; 2,000 W maximum heating capacity
Compressed air	–	4 – 6 bar
Weight	70 kg	Analyzer: 90 kg Sample loader: 10 resp. 15 kg
Dimensions (W x H x D)	55 x 80 x 60 cm	Analyzer: 55 x 100 x 60 cm Sample loader: 20 resp. 85 x 35 x 45 cm
Chemicals	CO <sub>2</sub> trap sodium hydroxide, H <sub>2</sub> O trap magnesium perchlorate	
Measuring principle	Infrared absorption for carbon and sulfur	
Carrier gas	Oxygen 99.5%, 2 – 4 bar	
Interfaces	serial and USB	
Accessories	Balance ±0.1 mg resolution / computer, monitor, printer (specifications on request)	

<sup>3)</sup>for path length ≥ 10 mm, otherwise Aluminum

**ELTRA**<sup>®</sup>  
ELEMENTAL ANALYZERS



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