CHNS Simultaneous Analysis of Coal and Coke Samples with the Elemental Analyzer vario EL

Elemental analytical results in coal analysis gain more and more in significance. From the elemental data heating values of fuels can be computed and/or serve for exact correction factors in computing the heating values. The determined nitrogen and sulfur contents can be used for evaluation of the nitric oxide and sulfur dioxide resulting from combustion.
The performance of these applications require a highly precise analysis.
The evaluation of fuels, especially coal, will be performed basically on the determined heating value.
The contents of carbon, sulfur, nitrogen and hydrogen are important parameters to optimize the operation of large furnaces and filter equipment. All relevant aspects and/or problems can be easily and cost effectively worked out by means of a simultaneous CHNS elemental analysis.

The advantages of simultaneous **CHNS** analysis with the elemental analyzer ***vario EL*** are:

labor, time and cost savings - since sample preparation is done only once (weighing and wrapping of the sample in tin boats, etc.) in order to determine the contents of the four elements C, H, N and S. Furthermore, no additional analyzer for S determination is required. This saves purchase and maintenance costs of an additional sulfur analyzer and laboratory space with additional media supply.

These advantages of a simultaneous CHNS analysis in connection with very good analytical instrument performance data make the vario EL elemental analyzer the ideal instrument for the micro and macro range, especially for the analysis of fossile solid fuels, also for hard to combust materials such as coke.

sample	weight [mg]	repe-titions	C [%] ± Sabs. [%]	H [%] ± Sabs. [%]	N [%] ± Sabs. [%]	S [%] ± Sabs. [%]
coal A	15 - 17	8	57.66 ± 0.07	3.28 ± 0.006	1.10 ± 0.003	0.57 ± 0.02
coal B	15 - 17	8	83.02 ± 0.04	3.89 ± 0.003	1.59 ± 0.004	1.03 ± 0.01
coke A	15 - 17	8	87.91 ± 0.04	0.88 ± 0.005	1.19 ± 0.005	0.66 ± 0.01
coke B	10	4	87.42 ± 0.094	0.98 ± 0.011	1.07 ± 0.003	0.71 ± 0.021
coke B	20	4	87.54 ± 0.036	0.97 ± 0.012	1.11 ± 0.017	0.68 ± 0.004
coke B	35	4	87.66 ± 0.021	0.95 ± 0.002	1.13 ± 0.005	0.66 ± 0.010
coal C	10	4	31.57 ± 0.12	2.55 ± 0.009	0.66 ± 0.007	1.36 ± 0.021
coal C	20	4	31.81 ± 0.04	2.60 ± 0.01	0.68 ± 0.003	1.36 ± 0.03
coal C	35	4	31.75 ± 0.01	2.59 ± 0.01	0.69 ± 0.004	1.37 ± 0.02
coal C	100	4	31.87 ± 0.04	2.60 ± 0.001	0.71 ± 0.014	1.25 ± 0.1
Sample material was provided by Ruhranalytik.						

The results of the simultaneous determination of various coal and coke samples give evidence to the analytical performance of the elemental analyzer vario EL. Furthermore, the sample weights and the results underline the use of the instrument as micro and macro analyzer.

It shows that also with low weights (10-20 mg) comparable results with higher weights can be achieved. It is possible to measure higher sample weights up to 100 mg (depending on the sample material and element content), thus having an immense advantage in particular for sample in homogeneities and saves large scale sample preparation techniques.

In order to be able to measure large sample weights (up to 100 mg) with excellent reproducibility, a landmark analyzer is required. In order to get such excellent results the following requirements have to be met: complete combustion and detection of the total resulted gas amounts. The ideal digestion is realized in the vario EL elemental analyzer via a direct oxygen supply to the sample (jet stream injection) in connection with an optimized time program, variable furnace temperature up to 1200°C and post combustion catalysts.

The required oxygen amount for the best combustion is rather low.

By means of a low helium carrier gas flow the gaseous reaction products will be separated dynamically after gas purification and reduction of the nitric oxides to nitrogen. The nitrogen travels directly to the thermal conductivity sensor (TCD). The other gases (CO_2, H_2O and SO_2) are bound in specific adsorption traps which are thermally desorbed and detected sequentially via the TCD (purge and trap system). The adsorption/desorption principle has the advantage that the entire amount of the corresponding combustion gas will be caught and detected interference-free also for difficult and/or long combustion processes. The utilisation of the TCD ensures the largest dynamic working and concentration range for the corresponding gases.

All these processes run fully automatic and PC controlled. Operating and evaluation software is Windows based which meets today's requirements (LIMS coupling).

The excellent analytical performance, the usability as micro and macro analyzer, the instrument concept with the ability of simultaneous CHNS determination in coal and coke samples make the elemental analyzer vario EL the ideal analyzer for quality monitoring in trade, service and industrial labs as well as in the R & D field.

All these aspects and the instrument concept (e.g. simultaneous CHNS analysis and the option the determine oxygen with the same instrument) make the vario EL analyzer a very versatile instrument for various applications such as fossile solid and liquid fuels, chemistry, pharmaceutical industry, petrochemical industry, materials industry, geological substances, environmental analysis and agricultural products.