Oxygen, Nitrogen and Hydrogen Analyzer EMGA-930/EMGA-830: In pursuit of High performance, Speed and Operability

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1 Introduction

Whether you are working for quality control in the steel industry or in a R&D laboratory for new materials our Oxygen, Nitrogen and Hydrogen elemental analyzers will give you very accurate and repeatable results. Thanks to the improved NDIR and TCD detectors, a standard deviation of 0.02 ppm is obtained for Oxygen and Nitrogen (World's best precision) and 0.04 ppm for Hydrogen together with wide measurement ranges enables the analysis of high concentration samples as well as traces.

In addition, with the EMGA-930 model, the "fully supported accessories" policy leads up to an easy and simple instrument to operate. The "automation systems" (Cleaning and Crucible loading) and "user-friendly software" including maintenance navigation will facilitate the training of new operators and reduce the variation in results between operators.

As this new generation's models have been optimized to fit user's requests they will answer most of the analytical problems you could encounter.

2 Instrumentation

2.1 Principle (see figure 2)

The sample is loaded into a graphite crucible which has been placed on the lower electrode and then elevated to make contact with the upper electrode of the impulse furnace. A high current passes through the crucible to create a high temperature (up to 3 000°C).
The gases extracted during the fusion are directly analyzed after the dust filter.
The Oxygen concentration is measured by two non dispersive Infra-red analyzers (NDIR), CO, CO_2, depending on the concentration in order to achieve very good accuracy along the full measurement range.

The Nitrogen in the sample is extracted as nitrogen gas (N_2) and its concentration is determined by a thermal conductivity detector (TCD).

The Hydrogen is measured with NDIR as H_2O after H_2 is oxidized throuh the CuO converter.

Figure 1: Model EMGA-930 for analysis of O/N/H concentration in solids

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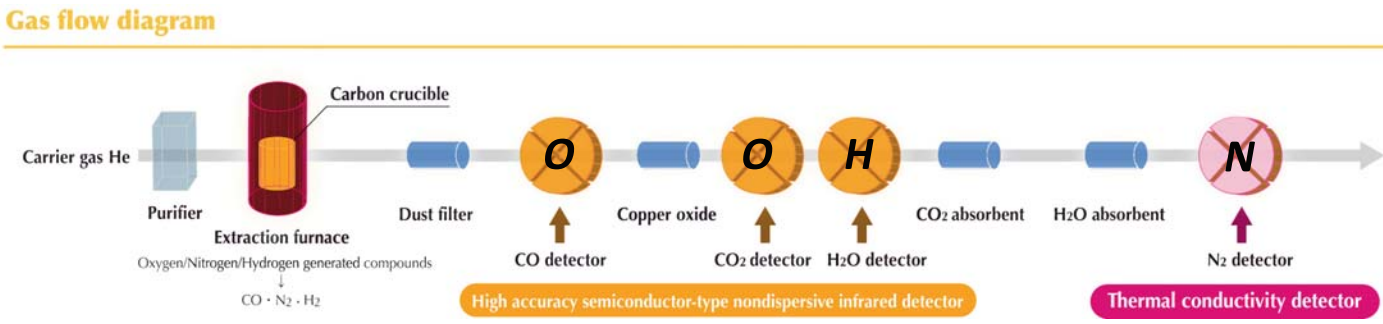

Figure 2: Gas flow diagram of the EMGA-830/EMGA-930

2.2 Super High Performance

Wide measurement range

Thanks to dual NDIR detectors measuring CO and CO_2 for Oxygen determination, one NDIR detector measuring H_2O for Hydrogen and optimized TCD design for Nitrogen determination, the EMGA series provide the widest measuring range: for a 1g sample Oxygen can be measured up to 5%, Nitrogen up to 3% and Hydrogen up to 0.25 %.

Precision

Likewise these optimizations lead to the World's best Oxygen/Nitrogen precision with a SD ≤ 0.02 ppm or a RSD ≤ 0.5%, whichever is larger, and a Hydrogen precision with SD ≤ 0.04 ppm or a RSD ≤ 2 %, measured with reference gas.

Standard method

Finally the EMGA-830/930 fulfills requirements of the standard methods for analysis of steel, titanium, tantalum, ceramics, etc. The main ones are listed here:

- ISO 10720:1997, ISO17053:2003
- JIS G1228:1997
- ASTM E1019, E1569, E1409

2.3 Unique features of EMGA-series

Dual Sample/Flux Introduction mechanism (figure 3)

This system allows the decontamination of the crucible and the flux. The following diagrams illustrate the 3 steps and the graphs illustrate the associated parameters evolution

1. The crucible is outgassed by a high current (high temperature).
2. The flux is introduced into the crucible and it is also outgassed.
3. The sample drops into the crucible for the analysis.

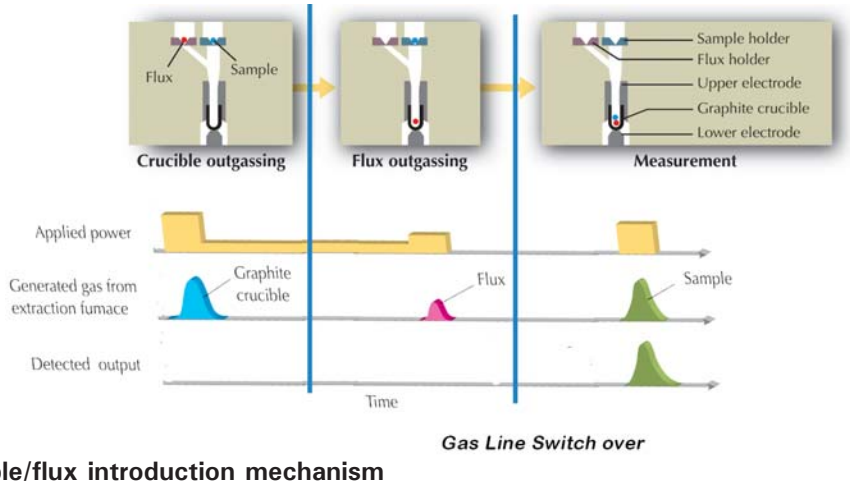

Figure 3: Dual sample/flux introduction mechanism

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Programmable temperature curves

Different functions allow the users to easily optimize the fusion temperature according to the sample. Some customized temperature curves can be carried out in order to observe various phenomena such as surface contamination, different phases or forms of Oxygen, Nitrogen and Hydrogen. "Hold" mode automatically optimizes the different temperature phases according to the samples.

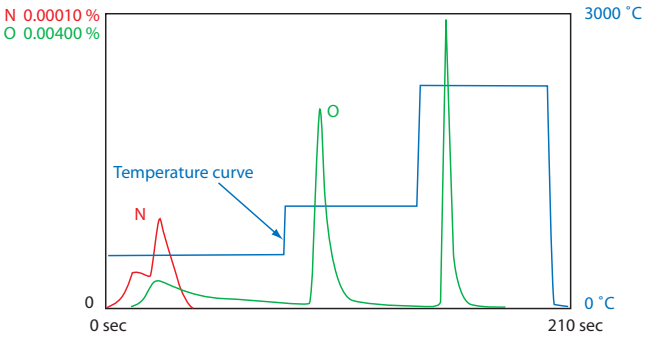

Figure 4: Oxide differentiation in iron powder

User friendly software with maintenance counter & navigator

In the maintenance window, you can reach pictures and videos illustrating maintenance operations by a simple click. Operators can freely have a look at the concerned area by playing with the 3D display. As the navigator describes the easy to-understand procedure for replacing parts, operators can perform routine maintenance without any experience or technical knowledge. In the same spirit of a multi-user facility, a maintenance counter informs operators about replacing consumables to assure consistent and accurate results.

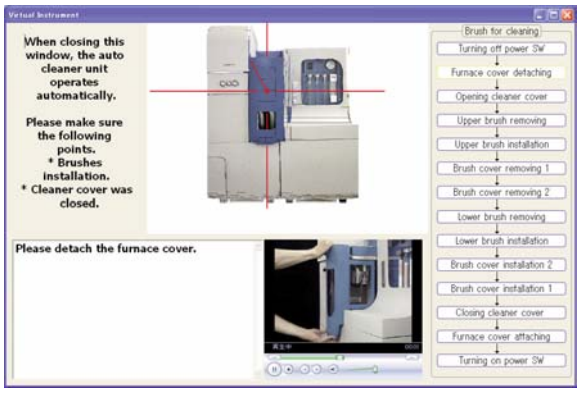

Figure 5: Software with maintenance counter

EMGA-930 model: Fully integrated accessories with simplified operations (These accessories are optional with the EMGA-830 series)

With integrated automations, operations are much simpler and faster. Just enter sample name, weight and put the sample in the EMGA. Analysis starts immediately and all operations are done fully automatically till next sample. It is total "hands clean" use, so the operator doesn't need to touch crucibles anymore and doesn't have contact with carbon dust. Furthermore, as automatic preparations are done while the next sample is being prepared, the gain in terms of time is about 40 s. compared with conventional systems.

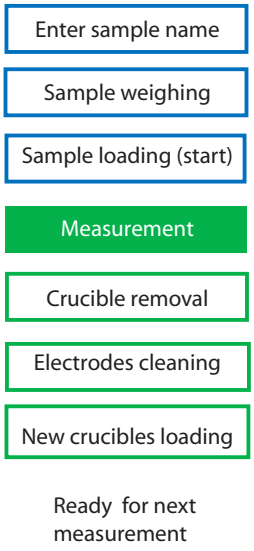

Figure 6: Sequence of measurement. (Steps in green are automatic)

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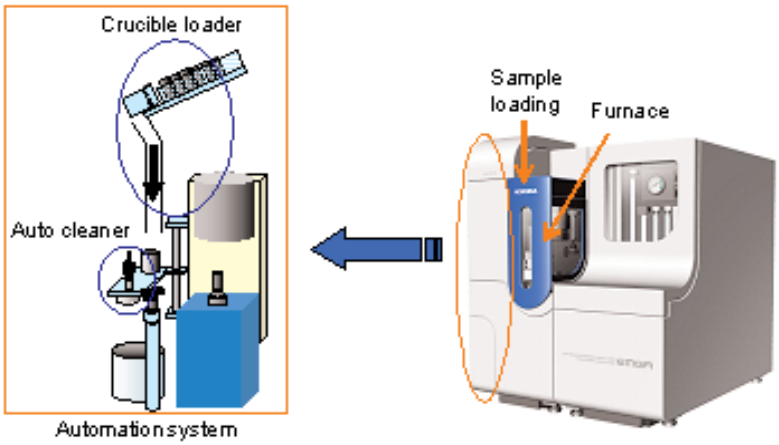

Figure 7: Details of the automation of the EMGA-930

- Automatic Cleaner (standard): After each analysis, the crucible is removed and discarded in the crucible waste box (approx 200 pcs). Two rotating brushes clean both upper and lower electrodes of the instrument. During the cleaning process, vacuum prevents contamination by removing all dust in the cleaner unit. The vacuum cleaner is included.

Figure 8: Image of autocleaner of the EMGA-930

- Automatic Crucible Loader (standard): Coupled with the auto cleaner, the crucible loader will automatically place a new crucible on the lower electrode just after the cleaning operation. The furnace closes and the instrument is ready to start the next analysis. Stepper motors are used for precise catch and positioning of the crucibles. The cassette capacity is 100 crucibles, the same number as packed in the crucible shipping box, which allows direct transfer of 100 crucibles into the loader at once.

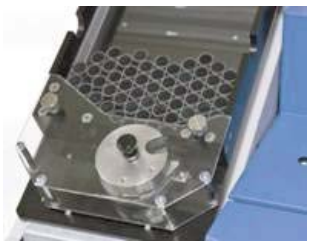

Figure 9: Image of crucible loader of the EMGA-930

- Automatic Gas Doser (standard): This feature is used to calibrate both elements using pure gases instead of solid samples (primary calibration). A fixed volume of gas is automatically injected in the carrier gas. Selection of the concentration in the cylinder determines the calibration level. For instance:
CO 1% in He 99% is equivalent to 70 ppm O for 1g sample
N_2 1% in He 99% is equivalent to 125 ppm N for 1g sample
H_2 1% in He 99% is equivalent to 9 ppm H for 1g sample

Figure 10: Image of crucible waste box of the EMGA-930

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3 Conclusion

EMGA-830 and EMGA-930 O/N/H analyzers are the "New flagship models" from our gas analyzer products line. With these instruments we will provide you the "Best of the best".
The main characteristic of the EMGA-series is its wide measurement range for Oxygen as well as Nitrogen and Hydrogen with an excellent precision over the full range. In addition these instruments provide you with unique features like a dual sample/flux introduction mechanism, programmable temperature curves and user friendly software. Moreover with the EMGA-9xx series you'll get fully supported accessories with simplified operations.

4 Specifications

	EMGA-930	EMGA-830AC	EMGA-830M
Oxygen	●	●	●
Nitrogen	●	●	●
Hydrogen	●	●	●
Auto Cleaner	●	●	-
Crucible Loader	●	-	-
Gas Doser	●	Option	Option
Minimum Reading	ONH: 0.001 ppm		
Repeatability (reference gas)	O/N: SD ≤ 0.02 ppm or RSD ≤ 0.5 % H: SD ≤ 0.04 ppm or RSD ≤ 2 %		
Measurement range for 1 g sample	O: up to 5 % N: up to 3 % H: up to 0.25 %		
Measurement time	Approx. 40 sec from gas extraction to result display *depending on sample and extraction conditions*		
Carrier gas	Helium		
Detectors	O: two NDIR (CO, CO_2) N: TCD H: NDIR (H_2O)		

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