OE750

Determination of ferrous alloys

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OE750 FOR HIGH-DEMAND FERROUS ANALYSIS

BACKGROUND

The new OE750 is a ground-breaking new OES metals analyser. Covering the complete spectrum of elements in metal, it has some of the lowest detection limits in its class.

Fast measurement times, high reliability and low operating costs mean the OE750 is invaluable for everyday analysis and total quality control, with performance on a par with larger and more expensive spectrometers.

The OE750 analyses all alloying, treatment, trace, residual and tramp elements for steel and iron applications.

It comes with software that makes analysis faster, more accurate and easier to interpret. This offers results analysis that helps with process control, and data management functionality allows full traceability of results – essential when it comes to audit time.

Optional extras include: adapters for wires and small samples, floor stand version, consumables and spare part kits, and sample preparation devices

KEY FEATURES

- Mid pressure system for extreme stability and highest transparency
- Wavelength range : 120 – 780 nm
- State-of-the-art CMOS high dynamic detectors
- Best optical resolution in class
- Minimised maintenance time
- Better reliability from newly developed excitation source

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APPLICATION OF FE ALLOYS (iron and steel)

Optical Emission is a well-established method for the elemental analysis for metals used over the past decades. It can be seen as the workhorse in the analysis of metal or alloys in the metallurgy industry. Spark optical emission spectrometers are used for the seamless quality control for any metalworking, starting with tramp element analysis for scrap, inspection of incoming materials, melt process control and goods issue.

We are surrounded by iron and steel products in our daily lives – from the utensils like cutlery to vehicles we travel, from the constructions like buildings to bridges, from small screws, nails…to big steel plates and structures – steel and iron are still the most metal we notice that iron and are the most produced and traded metals by far in this world of years!

Iron and steel are also important when it comes to manufacturing of countless machines and appliances that support other production businesses (used as raw material) or are used for residential/commercial purposes.

The importance of the iron and steel industry also lies in the fact that it is one of the highest revenue generating and high-employment industry sectors in the world.

The OE750 is ideal for the analysis of steel and iron materials. With a new detector technology the OE750 provides excellent analytical performance enabling the instrument to analyse ultra-low carbon steels, monitoring the nitrogen content in steel and iron casting processes, to determine other trace elements for these applications and of course to deliver trustable results on the main alloying elements.

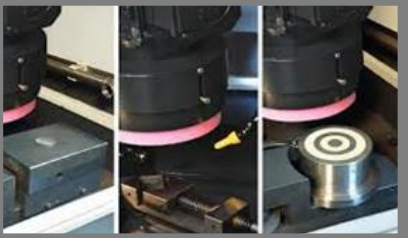
SAMPLE PREPARATION

Sample preparation is very important for OES if precise and accurate results are required. A flat sample surface is absolutely mandatory. Different techniques like grinding or milling can be appropriate depending on the material and the analytes.

Depending on the material of the analyte, typically aluminium oxide; if low Al concentrations have to be determined, alternatively zirconium oxide or silicon carbide. Grain size 40 - 80

Cast iron samples are typically prepared with grindstones or cup wheels (stone with segments) while steel is typically prepared with disc or belt grinding machines.

In this case, in order to perform sets of precession measurements, all samples were carefully and appropriately ground on a stationary disc grinder with mesh size 60 Al-corundum paper.



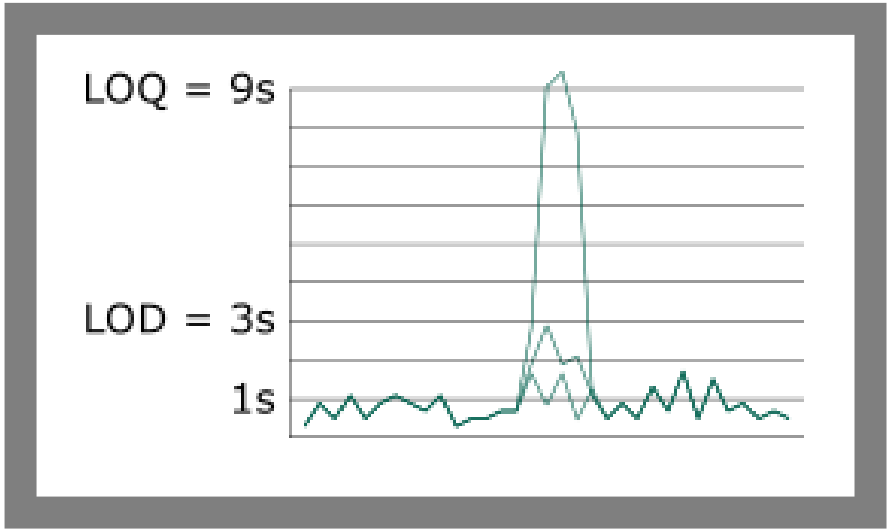
DIFFERENCE BETWEEN LOD AND LOQ

The BEC (equivalent concentration of spectral background) value is the concentration of the analysis sample required to produce the same intensity signal as the background at a given wavelength. The BEC is obtained from the calibration curve and is a fundamental process variable as it directly affects the LOD (**limit of detection**). The LOD is the smallest amount of an element detectable and it is calculated as follows:

$$LOD = \frac{3}{100} RSD_0 \times BEC$$

RSD_0 is correlated to the relative standard value of spectral background. With the BEC value calculated from the calibration curve, we are able to detect different elements in an alloyed copper base down to the level of precision (1δ).

However the **lowest quantitatively determinable amount** (Limit of Quantitation or LOQ) must be larger than the spectrometric LOC by a multiple of three. The resulting LOQ is the quantitatively readable value with our instrument.



Slickers. K. 1993. *Automatic-Atomic-Emission-Spectroscopy*. 2nd Edition. D-35334 Giessen. Germany: Brühlsche Universitätsdruckerei

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SUB programs & calibration range Fe base

		Fe 100 Low Alloys		Fe 150 Free Cutting Steel		Fe 200		Fe 250		Fe 300		Fe 400		Fe 500		Fe 000 Orientation		Fe Overview	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Al	Aluminium	0.0005	1.6	0.0005	1.6	0.0002	1.6	0.0005	0.3	0.005	6	0.0005	0.5	0.0005	0.6	0.0010	6000	0.0002	6
As	Arsenic	0.0005	0.15	0.0005	0.15	0.0005	0.15					0.0005	0.15					0.0005	0.15
B	Boron	0.0001	0.15	0.0001	0.15	0.0001	0.15	0.0001	0.1	0.0001	0.1							0.0001	0.15
Bi	Bismuth	0.0005	0.15	0.0005	0.15	0.0005	0.15											0.0005	0.15
C	Carbon	0.0005	1.8	0.001	1.8	1	5	1	5	0.0005	0.25	0.001	3	0.0005	2	0.0010	5500	0.0005	5
Ca	Calcium	0.0001	0.008	0.0001	0.008					0.0001	0.008							0.0001	0.008
Ce	Cerium					0.001	0.2											0.001	0.2
Co	Cobalt	0.0005	1.25	0.0005	1.25	0.0005	2	0.0005	0.35	0.0005	10	0.0005	14	0.0005	0.6	0.0005	14.00	0.0005	14
Cr	Chromium	0.0005	6	0.0005	6	0.0005	3	0.0005	40	0.0005	40	0.0005	24	0.0005	6	0.0005	45.00	0.0005	40
Cu	Copper	0.0002	1	0.0002	1	0.0002	3	0.0002	11	0.0002	8			0.0002	1	0.0002	12.00	0.0002	11
La	Lanthanum					0.0002	0.1											0.0002	0.1
Mg	Magnesium					0.0001	0.15											0.0001	0.15
Mn	Manganese	0.0005	3	0.0005	3	0.0005	2.5	0.0005	2.5	0.0005	18	0.0005	1.5	5	24	0.0005	24.00	0.0005	24
Mo	Molybdenum	0.0005	2	0.0005	2	0.001	2	0.0005	4.5	0.0005	8	0.0005	12	0.0005	2.5	0.0005	12.00	0.001	12
N	Nitrogen	0.001	0.5	0.001	0.5	0.0005	1			0.001	1			0.001	0.5			0.0005	1
Nb	Niobium	0.0005	2	0.0005	2	0.001	0.5	0.0005	0.5	0.0005	3.5	0.0005	1	0.0005	2	0.0005	3500	0.0005	3.5
Ni	Nickel	0.0005	6	0.0005	6	0.0005	4	0.0005	35	0.0005	55	0.0005	2	0.0005	4.5	0.0005	55.00	0.0005	55
P	Phosphorous	0.0005	0.2	0.0005	0.2	0.0002	2	0.0005	0.25	0.0005	0.2	0.0005	0.2	0.0005	0.2	0.0005	0.2000	0.0002	2
Pb	Lead	0.0005	0.1	0.0005	0.5	0.001	0.5			0.001	0.5			0.001	0.5	0.0010	0.5000	0.0005	0.5
S	Sulfur	0.0005	0.2	0.0005	0.4	0.0005	0.2	0.0005	0.2	0.0005	0.4	0.0005	0.2	0.0005	0.2	0.0005	0.2000	0.0005	0.4
Sb	Antimony	0.001	0.2	0.001	0.2	0.001	0.25			0.002	0.2							0.001	0.25
Se	Selenium	0.001	0.25	0.001	0.25	0.001	0.25			0.0005	0.25							0.0005	0.25
Si	Silicon	0.0005	2.25	0.0005	2.25	0.0005	5.5			0.0005	2.5	0.0005	1.5	0.0005	2.5	0.0010	5500	0.0005	5.5
Sn	Tin	0.0005	0.3	0.0005	0.3	0.0005	0.3	0.0005	0.2	0.0005	0.3	0.0005	0.1	0.0005	0.3	0.0005	0.3000	0.0005	0.3
Ta	Tantal	0.005	0.3	0.005	0.3	0.0005	0.2			0.005	0.2							0.0005	0.3
Ti	Titanium	0.0002	1	0.0002	1	0.0002	0.5	0.0002	0.5	0.0002	2	0.0002	0.25	0.0002	1.3	0.0002	1000	0.0002	2
V	Vanadium	0.0005	1	0.0005	1	0.0002	1	0.0005	1	0.0005	2	0.0002	12	0.0005	0.5	0.0005	12.00	0.0002	12
W	Tungsten	0.003	0.2	0.003	0.2	0.003	0.2	0.002	0.5	0.003	4	0.002	24	0.003	1.5	0.0020	24.00	0.002	24
Zn	Zinc	0.0002	0.05	0.0002	0.05	0.0002	0.05											0.0002	0.05
Zr	Zirconium	0.0005	0.5	0.0005	0.5	0.0005	0.2			0.0005	0.5							0.0005	0.5
FE	Iron	Internal Standard																	

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Table of precision Fe alloys

Element	Al	As	B	Bi	C	Ca	Ce	Co	Cr	Cu	La	Mg	Mn	Mo	N
LOD	5	3	1	5	5	1	10	2	5	1	1	1	5	5	10
Concentration range (%)	0.0005-6.000	0.0005-0.1500	0.0001-0.1500	0.0005-0.1500	0.0005-5.000	0.0001-0.080	0.0010-0.2000	0.0005-14.00	0.0005-40.00	0.0002-11.00	0.0002-0.1	0.0001-0.1500	0.0005-24.00	0.0005-12.00	0.001-1.000

Precision (1s) in % -ranges															
0.001	0.0001	0.0001	0.0001	0.0002	0.0005	0.0001		0.0001	0.0005	0.0001	0.0002	0.0002	0.0005	0.0002	0.0005
0.005	0.0005	0.0003	0.00015	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0001	0.0005	0.0005	0.0005	0.0005	0.0008
0.01	0.0006	0.0004	0.0005	0.0012	0.0003	0.0005	0.001	0.0002	0.0005	0.0005	0.0005	0.001	0.0005	0.0008	0.001
0.05	0.0008	0.0008	0.0008	0.001	0.001	0.001	0.0025	0.0003	0.0008	0.0006	0.0005	0.0025	0.0005	0.0015	0.002
0.1	0.002	0.002	0.001	0.002	0.001		0.003	0.0005	0.001	0.0007	0.0009	0.003	0.001	0.0015	0.003
0.5	0.005				0.003			0.002	0.0015	0.0025			0.0015	0.003	0.005
1.0	0.015				0.008			0.004	0.005	0.05			0.004	0.008	0.015
5	0.025				0.03			0.04	0.015	0.05			0.015	0.06	
10								0.06	0.03	0.08			0.03	0.08	
20									0.05				0.075		
30									0.1						

Element	Nb	Ni	P	Pb	S	Sb	Se	Si	Sn	Ta	Ti	V	W	Zn	Zr
LOD	2	5	2	5	5	10	5	5	5	5	2	2	20	1	5
Concentration range (%)	0.0005-3.5	0.0005-55.00	0.0002-2.000	0.0005-0.5000	0.0005-0.4000	0.001-0.2500	0.0005-0.2500	0.0005-5.500	0.0005-0.3000	0.0005-0.3000	0.0002-2.000	0.0002-12.00	0.0020-24.00	0.0002-0.0500	0.0005-0.5000

Precision (1s) in % -ranges															
0.001	0.0005	0.0005	0.0001	0.0005	0.0005		0.0005	0.0005	0.0005	0.0005	0.0001	0.0003		0.0001	0.0005
0.005	0.0005	0.0008	0.0002	0.0002	0.0005	0.0003	0.0005	0.0005	0.0002	0.0015	0.0002	0.0002	0.005	0.0002	0.0005
0.01	0.0005	0.001	0.0005	0.0003	0.0008	0.0005	0.0008	0.0005	0.0002	0.002	0.0003	0.0003	0.002	0.0004	0.001
0.05	0.0006	0.001	0.0008	0.0006	0.0015	0.002	0.0015	0.001	0.0006	0.002	0.001	0.0004	0.0035		0.0012
0.1	0.001	0.002	0.001	0.001	0.002	0.005	0.002	0.001	0.001	0.003	0.002	0.001	0.004		0.0025
0.5	0.002	0.002	0.0015	0.002	0.004			0.005			0.005	0.004	0.005		0.003
1.0		0.01	0.02					0.001			0.01	0.006	0.02		
5		0.05						0.003				0.02	0.06		
10		0.08										0.05	0.085		
20		0.15											0.15		
30		0.2													

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PERFORMANCE DISCLAIMER

Calibration ranges can be extended with customer's samples.
Values obtained for certified reference samples only!
Samples must be flat grinded or milled!

The published values are averaged data from very different type of material and should be regarded as "typical" values.