OE 750

Determination of nickel alloys

HITACHI
Inspire the Next

OE750 FOR HIGH-DEMAND NICKEL 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 nickel 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

OE 750

Determination of nickel alloys

APPLICATION OF NI ALLOYS

Nickel is a naturally-occurring metallic element with a silvery-white, shiny appearance. It is the fifth-most common element on earth and occurs extensively in the earth's crust and core. Nickel, along with iron, is also a common element in meteorites and can even be found in small quantities in plants, animals and seawater.

Nickel will alloy readily with many other metals, including chromium, iron, molybdenum and copper. This allows for a wide variety of alloys that demonstrate outstanding resistance to corrosion and high-temperature scaling, exceptional high-temperature strength and other unique properties, such as shape memory and low coefficient of expansion.

The OE750 is ideal for the analysis of nickel and nickel alloys. With a new detector technology the OE750 provides excellent analytical performance enabling the instrument to analyse all types of nickel alloys, monitoring the nitrogen content during casting processes, to determine other trace elements like lead and tin and of course to deliver trustable results on the main alloying elements.

The Nickel institute: https://www.nickelinstitute.org/about-nickel/nickel-alloys/

OE 750

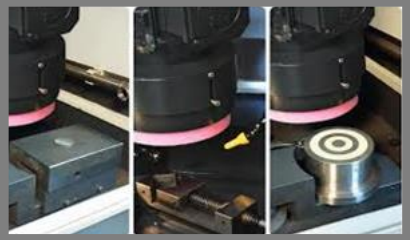
Determination of nickel alloys

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

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.



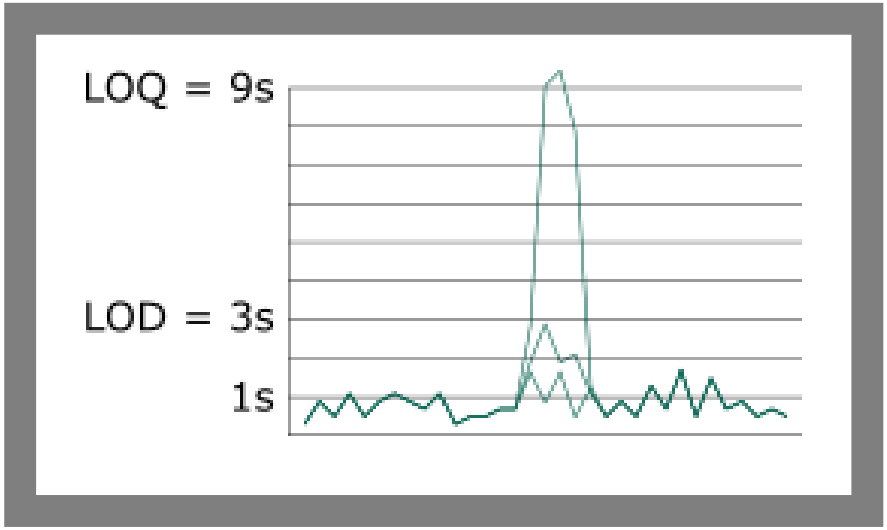
DIFFERENCE BETWEEN LOD AND LOQ

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

OE 750

HITACHI
Inspire the Next

Determination of nickel alloys

SUB programs & calibration range Ni alloys

		Ni_100 Low alloy		NI_200 Monel		NI_300		Ni_400		Ni_500		NI_600		Ni_700		NI_000 Orientation		Nickel Overview	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Al	Aluminum	0.0005	0.5	0.0005	5	0.001	8	0.0005	2	0.0005	8	0.0005	4	0.5	8	0.0005	8	0.0005	8
B	Boron					0.0001	0.25	0.0002	0.5	0.0002	0.5	0.0002	1	0.0001	0.5	0.0005	3.5	0.0001	1
C	Carbon	0.0005	0.5	0.0005	0.1	0.0005	0.3	0.0005	0.5	0.0005	0.5	0.0005	1	0.0005	0.5	0.0005	1	0.0005	1
Co	Cobalt	0.0005	1.2	0.001	1.2	7.5	23	0.001	4	0.25	22	0.001	5	2	22	0.001	25	0.0005	23
Cr	Chromium	0.0002	0.5	0.0002	1	0.25	35	0.0002	40	10	35	0.0002	30	2	30	0.0005	40	0.0002	40
Cu	Copper	0.0002	0.5	22	35	0.0002	1	0.0002	2.5	0.0002	4	0.0002	2	0.0002	1	0.0002	40	0.0002	35
Fe	Iron	0.0005	0.5	0.0005	3.5	0.0005	2.5	25	45	0.0005	32	0.0005	20	0.0005	1.5	0.0005	55	0.0005	45
Hf	Hafnium													0.0005	2.2	0.0005	2	0.0005	2.2
Mg	Magnesium	0.0001	0.5	0.0001	0.25	0.0001	0.25	0.0001	0.25	0.0001	0.25	0.0001	0.25	0.0001	0.25	0.0001	0.25	0.0001	0.5
Mn	Manganese	0.0005	0.5	0.0002	3.2	0.0002	1	0.0005	2	0.0005	2	0.0005	2	0.0005	1	0.0005	3.5	0.0002	3.2
Mo	Molybdenium					0.0005	12	0.0002	10	0.0002	12	5	40	0.0005	6	0.0005	40	0.0002	40
N	Nitrogen									0.002	0.5	0.002	0.5					0.002	0.5
Nb	Niobium			0.001	1	0.001	0.5	0.001	1	0.001	8	0.001	5	0.001	1.5	0.001	8	0.001	8
P	Phosphorous			0.0002	0.1	0.0002	0.1	0.0002	0.1	0.0002	0.1	0.002	0.1	0.0002	0.1			0.0002	0.1
Pb	Lead			0.0005	0.1													0.0005	0.1
S	Sulphur	0.0002	0.15	0.0005	0.1	0.0005	0.15	0.0005	0.15	0.0005	0.15	0.0005	0.1					0.0002	0.2
Si	Silicon	0.0005	1	0.0005	5.5	0.0005	1.2	0.0005	3	0.0005	3	0.0005	8	0.0005	1	0.0005	8	0.0005	8
Sn	Tin			0.0002	1	0.0002	1									0.0002	1	0.0002	1
Ta	Tantalum					0.0005	5							0.001	8	0.001	7	0.0005	8
Ti	Titanium	0.0005	0.5	0.0005	1.8	0.0005	6	0.0005	3	0.0005	7	0.0005	1	0.0005	5	0.001	8	0.0005	7
V	Vanadium					0.0002	1.25	0.0002	1.25	0.0002	1.25	0.0005	1.25	0.0005	1.25	0.0005	1.25	0.0002	1.3
W	Tungsten					0.002	4	0.002	6	0.002	5	0.002	7	0.002	13.5	0.002	13	0.002	13.5
Zr	Zirconium					0.0005	0.5	0.001	0.2	0.001	0.2			0.001	0.5	0.001	0.5	0.0005	0.5
		Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard	Internal Standard

OE 750

HITACHI
Inspire the Next

Determination of nickel alloys

Table of precision Ni alloys

Element	Al	B	C	Co	Cr	Cu	Fe	Hf	Mg	Mn	Mo	N
Limit of detection (ppm)	5	1	5	5	2	2	5	5	1	2	2	20
Concentration range (%)	0.0005 - 8.0	0.0001 - 1.0	0.0005 - 1.0	0.0005 - 23.0	0.0002 - 40.0	0.0002 - 35	0.0005 - 45.0	0.0005 - 2.2	0.0001 - 0.5	0.0002 - 3.2	0.0002 - 40.0	0.0020 - 0.5
Precision (1s) in % - ranges												
0.001	0.0001	0.0001	0.0003	0.0005	0.0001	0.0005	0.001	0.0006	0.0002	0.0006	0.0001	0.001
0.005	0.0001	0.0001	0.0003	0.001	0.0002	0.0006	0.001	0.0006	0.0002	0.0007	0.0003	0.001
0.01	0.0003	0.0002	0.0005	0.0015	0.0002	0.0008	0.001	0.0006	0.0004	0.0008	0.0005	0.005
0.02	0.0005	0.0005	0.001	0.002	0.0003	0.001	0.001	0.001	0.001	0.001	0.0015	0.005
0.05	0.001	0.0015	0.0015	0.002	0.0004	0.0015	0.001	0.001	0.005	0.0015	0.003	0.01
0.1	0.0025	0.0035	0.003	0.0025	0.0005	0.002	0.0015	0.001	0.008	0.002	0.003	0.01
0.2	0.004	0.005	0.006	0.003	0.001	0.003	0.0025	0.0015	0.01	0.005	0.0035	0.01
0.5	0.005	0.008	0.008	0.005	0.005	0.006	0.0035	0.006	0.015	0.008	0.004	0.015
1	0.015	0.008	0.01	0.007	0.01	0.012	0.005	0.008		0.015	0.005	
2	0.03			0.012	0.02	0.022	0.013	0.01		0.02	0.01	
43588	0.05			0.019	0.035	0.037	0.025			0.03	0.025	
5	0.05			0.025	0.05	0.05	0.04				0.05	
10	0.08			0.05	0.1	0.1	0.085				0.1	
15				0.08	0.11	0.11	0.135				0.11	
20				0.1	0.12	0.12	0.2				0.12	
30				0.15	0.15	0.15	0.3				0.15	
50					0.2		0.5				0.2	

OE 750

HITACHI
Inspire the Next

Determination of nickel alloys

Table of precision Ni alloys

Element	Nb	P	Pb	S	Si	Sn	Ta	Ti	V	W	Zr
Limit of detection (ppm)	10	2	5	2	5	2	5	5	2	20	5
Concentration range (%)	0.0010 - 8.0	0.0002 - 0.1	0.0005 - 0.1	0.0002 - 0.2	0.0005 - 8.0	0.0002 - 1.0	0.0005 - 8.0	0.0005 - 7.0	0.0002 - 1.3	0.0020 - 13.5	0.0005 - 0.5
Precision (1s) in % - ranges											
0.001	0.0005	0.0004	0.0002	0.0003	0.0005	0.0001	0.0005	0.003	0.0006	0.0015	0.0006
0.005	0.001	0.0003	0.0002	0.0002	0.0005	0.0002	0.0005	0.003	0.0006	0.0015	0.0006
0.01	0.0012	0.0006	0.0004	0.0012	0.0006	0.0005	0.0006	0.003	0.0006	0.0015	0.0006
0.02	0.0015	0.0015	0.001	0.007	0.001	0.001	0.001	0.003	0.001	0.0015	0.0005
0.05	0.0015	0.015	0.005	0.015	0.001	0.001	0.001	0.003	0.001	0.002	0.001
0.1	0.002	0.05	0.02	0.02	0.0015	0.001	0.0015	0.0025	0.001	0.002	0.005
0.2	0.003			0.05	0.0025	0.0015	0.0025	0.0025	0.0015	0.003	0.01
0.5	0.005				0.005	0.006	0.005	0.003	0.006	0.005	0.015
1	0.01				0.009	0.008	0.009	0.01	0.008	0.01	
2	0.02				0.017		0.017	0.05	0.01	0.02	
43588	0.025				0.025		0.025	0.15		0.03	
5	0.04				0.03		0.03	0.3		0.05	
10	0.06				0.05		0.05			0.075	
15										0.15	

OE 750

Determination of nickel alloys

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.