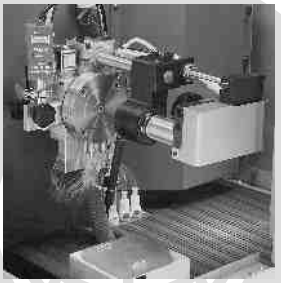
Spectroscopy Application Note

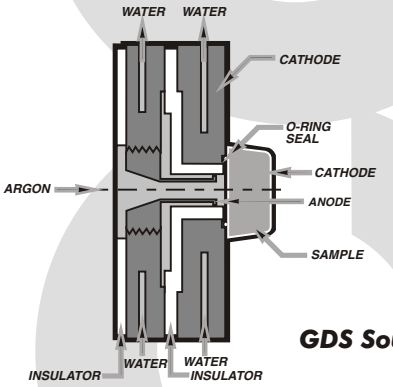
Analysis of Cobalt Base Alloys

Cobalt base alloys are typically associated with applications requiring wear, corrosion, or heat resistance. The chemical composition of these alloys signifies the basis for which application they are best suited.

LECO manufactures three glow discharge optical emission spectrometers designed for optimum elemental determination in ferrous and nonferrous materials. A "glow discharge" source uniformly removes material from the sample surface. The separation of sampling from sample excitation reduces the effect of metallurgical and chemical history inherent in all samples. The excitation of primarily ground state atom lines gives rise to less complex spectra, minimizing and/or eliminating many interferences. Calibration curves are linear and cover a very wide dynamic range. The same wavelengths are often used for both high and low concentration ranges.



GDS Lamp



GDS Source

Typical Sample Results

Stellite 1 #LO 2228

	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	25.73	11.11	0.36	2.22	1.64	1.42	1.09	0.11	0.0074	0.03	0.0086
Std Dev	0.078	0.12	0.0022	0.022	0.016	0.014	0.0044	0.0018	0.0001	0.0002	0.0004
RSD (%)	0.3	1.12	0.6	1.0	0.96	1.0	0.4	1.59	0.97	0.59	5.12

Stellite 21 #LO 2234

	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	26.81	0.41	5.5	0.22	0.69	2.48	0.63	0.52	N/A	0.063	N/A
Std Dev	0.098	0.0042	0.0017	0.0002	0.0057	0.008	0.0005	0.0069	—	0.0065	—
RSD (%)	0.37	1.03	0.03	0.11	0.83	0.32	0.08	1.32	—	10	—

Alloy 800 #LO 2240

	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	17.55	0.021	28.49	0.01	1.34	1.33	3.11	0.03	0.008	N/A	N/A
Std Dev	0.11	0.0031	0.067	0.00004	0.0059	0.016	0.012	0.0003	0.00001	—	—
RSD (%)	0.62	15.0	0.23	0.37	0.44	1.23	0.37	0.88	0.14	—	—

CO-Cr-W #LO 2238

	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	29.32	19.66	0.25	0.63	2.77	5.44	0.79	0.26	0.023	0.024	0.061
Std Dev	0.025	0.066	0.0013	0.0049	0.017	0.01	0.0019	0.0013	0.0002	0.00005	0.0001
RSD (%)	0.09	0.34	0.52	0.77	0.61	0.18	0.24	0.48	0.74	0.21	0.19

UNCO 50 #LO 2520

	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	27.54	1.06	0.011	0.14	28.3	0.61	0.77	0.84	0.0006	0.016	0.20
Std Dev	0.059	0.022	0.0002	0.0004	0.082	0.0005	0.0024	0.0053	0.00001	0.00004	0.0012
RSD (%)	0.21	2.0	1.48	0.3	0.29	0.074	0.31	0.63	1.67	0.26	6.18

GDS-Series

Typical Results—Certified Cobalt Standards

Brammer BS 170B, Cobalt Alloy 6B

	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	30.51	3.95	0.81	1.12	0.92	2.50	0.71	1.40	0.00041	0.016	0.027
Std Dev	0.011	0.011	0.0034	0.023	0.0058	0.012	0.0039	0.0024	0.00002	0.0002	0.00083
RSD (%)	0.037	0.28	0.42	2.1	0.63	0.49	0.54	0.17	6	1.3	3.1
Certified	*30.52*	*3.98*	*0.81*	*1.12*	*0.91*	*2.49*	*0.71*	*1.41*	*0.00040*	*0.016*	*0.027*

IARM 96A Stellite 25

	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	20.11	15.16	0.28	0.010	2.29	10.53	0.17	1.52	0.0030	0.040	0.069
Std Dev	0.0010	0.023	0.00064	0.00038	0.0050	0.017	0.0012	0.0045	0.00001	0.00011	0.00086
RSD (%)	0.0052	0.15	0.23	3.8	0.22	0.16	0.69	0.3	0.56	0.300	1.2
Certified	*20.17*	*15.20*	*0.28*	*0.010*	*2.29*	*10.53*	*0.17*	*1.52*	*0.0030*	*0.040*	*0.070*

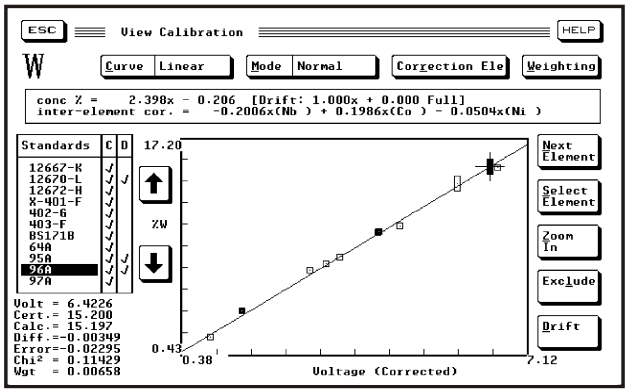
MBH 14942-L Stellite 8

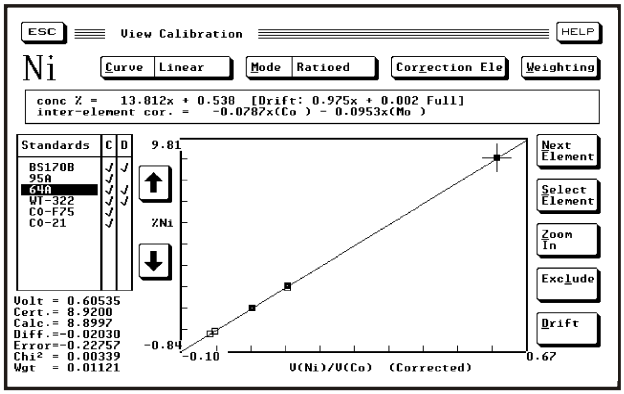
	Cr	W	Mo	C	Fe	Ni	Si	Mn	B	Cu	Nb
Avg (%)	29.01	1.58	6.28	0.097	1.07	0.27	1.09	0.48	N/A	N/A	N/A
Std Dev	0.023	0.0046	0.0098	0.0002	0.0026	0.0008	0.0020	0.0009	—	—	—
RSD (%)	0.079	0.29	0.16	0.17	0.25	0.30	0.18	0.19	—	—	—
Certified	*28.56*	*1.60*	*6.39*	*0.10*	*1.07*	*0.27*	*1.07*	*0.49*	—	—	—

Analyses shown were run on the LECO GDS-400A.

Calibration

Linear working curves are found with LECO glow discharge spectrometers. Single wavelength lines often cover full concentration ranges. Linear calibrations correlate to low reference material consumption and few spectral interferences.





Sample Preparation

The techniques specified in ASTM Practices and Standards apply to glow discharge. As a non-thermal sputtering source, glow discharge does not rely on high temperatures to melt and volatize samples. Craftsman-like machining techniques are avoided, and surface preparation with belt or disc grinders will easily provide a uniform surface sufficient for glow discharge. Cobalt base alloys are typically abraded with a 120 grit zirconium oxide belt/disc.

Accessories

Sample surface preparation (LECO BG-30, VP-160 or other suitable equipment).

Calibration Standards

Based on customer requirements; NIST, Brammer, MBH, ARMI or other suitable standards.

Typical Analysis Times

Start-up and Pre-burn	~30 seconds
Analyze	~15 seconds
Total	~45 seconds

***LECO Corporation* • 3000 Lakeview Ave. • St. Joseph, MI 49085-2396**
Phone: 800-292-6141 • Fax: 269-982-8977
info@leco.com • www.leco.com • *ISO-9001 No. FM 24045*

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