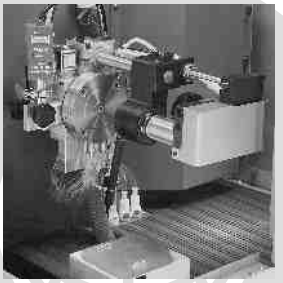
Spectroscopy Application Note

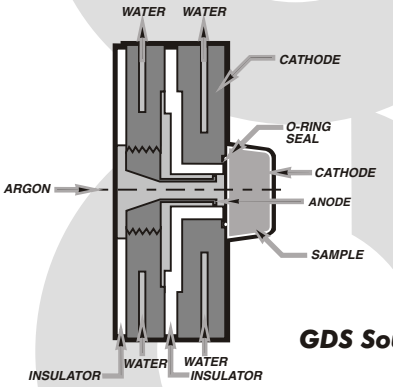
Analysis of Zinc Base Alloys

The primary use for zinc today is the coating of steel products. While zinc alloys are used in a variety of forms, impurity limits are carefully monitored to assure mechanical and corrosion properties.

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

Z-3 #LO 2435

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.0062	0.034	N/A	3.97	0.054	0.0025	0.033	N/A	N/A	0.0014	N/A
Std Dev	0.0004	0.0066	—	0.092	0.0029	0.0003	0.0009	—	—	0.0004	—
RSD (%)	6.33	20	—	2.31	5.36	13	2.73	—	—	29	—

ZA-8 #LO 2437

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.0018	0.020	N/A	8.81	1.19	0.0055	0.022	N/A	N/A	0.0033	N/A
Std Dev	0.0002	0.0037	—	0.037	0.0054	0.0001	0.0001	—	—	0.0001	—
RSD (%)	9.37	19	—	0.42	0.45	2.18	0.39	—	—	2.38	—

Slush Zinc #LO 2438

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.0073	0.016	N/A	5.26	0.054	0.0038	0.0076	N/A	N/A	0.0016	0.073
Std Dev	0.0001	0.0010	—	0.050	0.0016	0.0002	0.0001	—	—	0.0001	0.018
RSD (%)	1.8	6.27	—	0.94	2.93	4.99	0.72	—	—	8.44	25

ZA-27 #LO 2439

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.0044	0.090	N/A	26.33	2.23	0.0060	0.019	0.013	0.0014	0.022	N/A
Std Dev	0.00004	0.0057	—	0.34	0.0060	0.0001	0.0002	0.0004	0.00002	0.0006	—
RSD (%)	0.91	6.36	—	1.27	0.27	0.91	1.10	2.76	1.48	2.64	—

Zn - Al Alloy #LO 2770

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.0029	0.28	0.0017	51.44	0.57	0.021	0.0083	0.0032	0.0026	0.0079	1.55
Std Dev	0.0002	0.0011	0.00002	0.12	0.0045	0.0002	0.0001	0.0001	0.0001	0.00002	0.023
RSD (%)	5.39	0.38	1.26	0.23	0.79	1.04	0.91	2.91	3.33	0.19	1.45

GDS-Series

Typical Results—Certified Zinc Standards

NIST 629 Zinc Base E

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.012	0.015	0.0156	5.15	1.51	0.012	0.096	0.0078	0.00074	0.0019	0.079
Std Dev	0.00038	0.0017	0.00031	0.039	0.018	0.00026	0.0022	0.00051	0.00006	0.00035	0.0013
RSD (%)	3.1	11.5	2.0	0.8	1.2	2.1	2.3	6.6	8.6	18.0	1.7
Certified	*0.0135*	*0.017*	*0.0155*	*5.15*	*1.50*	*0.012*	*0.094*	*0.0080*	*0.00080*	*0.0017*	*0.078*

MBH 43XZ22 ZA27

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.002	0.16	0.0020	25.98	2.40	0.0070	0.018	N/A	N/A	0.0062	N/A
Std Dev	0.00027	0.0079	0.00005	0.11	0.0048	0.00010	0.00017	—	—	0.00026	—
RSD (%)	14	4.9	2.7	0.42	0.20	1.5	0.96	—	—	4.2	—
Certified	*0.002*	*0.16*	*0.0020*	*25.9*	*2.40*	*0.0070*	*0.018*	—	—	*0.0060*	—

NIST 631 Zinc Spelter

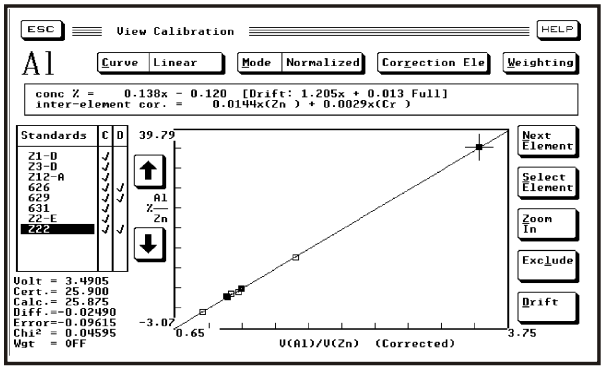
	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.00090	0.0055	N/A	0.50	0.0012	0.00084	0.00056	0.00070	N/A	N/A	0.0010
Std Dev	0.00012	0.0014	—	0.022	0.00019	0.00026	0.00002	0.00015	—	—	0.00027
RSD (%)	14	25	—	4.3	6.2	31	3.6	22	—	—	27
Certified	*0.0010*	*0.0050*	—	*0.50*	*0.0013*	*0.0010*	*0.00050*	*0.00050*	—	—	*0.0010*

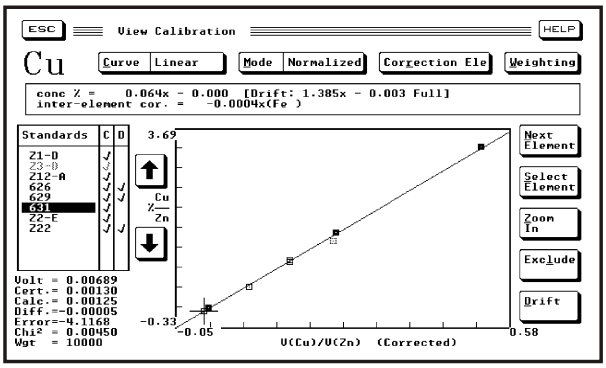
NIST 627 Zinc Base C

	Pb	Fe	Cd	Al	Cu	Sn	Mg	Ni	Cr	Mn	Si
Avg (%)	0.0076	0.022	0.0053	3.88	0.135	0.0042	0.031	0.0028	0.0039	0.016	0.022
Std Dev	0.00006	0.0032	0.00003	0.029	0.00097	0.00001	0.00042	0.00024	0.00021	0.0045	0.013
RSD (%)	0.9	15.0	0.6	0.8	0.7	0.4	1.4	9.0	5.4	28	58
Certified	*0.0082*	*0.023*	*0.0051*	*3.88*	*0.132*	*0.0042*	*0.030*	*29*	*0.0038*	*0.014*	*0.021*

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. Zinc base alloys are typically abraded with a 320 grit silicon carbide wet disc to provide a uniform surface and prevent smearing.

Accessories Sample surface preparation (LECO 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

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