Spectroscopy Performance Note

Analysis of Cast Irons

Preface

Cast irons are a major family of ferrous alloys containing percentage levels of carbon and silicon. Alloying elements such as chromium and nickel enhance the physical properties of the metal while the structure maintains a rich carbon phase. Whether the objective is to improve the strength, abrasion resistance, corrosion resistance, or another characteristic of the basic iron, the chemical composition must be controlled in order to achieve the desired physical properties. Chilled buttons or coupons are typically cast for quick analysis. As-cast iron, both gray and ductile, can be analyzed by the GDS500A.

The LECO GDS500A is an atomic emission spectrometer that records the spectra of each analysis; a virtually limitless number of wavelengths can be defined. The glow discharge source uniformly removes (sputters) material from the sample surface. Analysis takes place away from the sample surface, reducing the effect of metallurgical and chemical history inherent in all samples. The excitation of primarily ground state atom lines means less complex spectra and less interference. Calibration curves are linear and cover a wide dynamic range.

Typical Analysis Results

CHILLED DUCTILE IRON: BRAMMER STANDARD BS284C

ELEMENT	C %	Cr %	Cu %	Mg %	Mn %	Mo %	Ni %	P %	S %	Si %	Ti %	V %	Fe %
AVERAGE	3.90	0.071	0.14	0.015	0.46	0.009	0.041	0.030	0.008	1.84	0.012	0.009	93.47
CERT	3.80	0.073	0.15	0.015	0.46	0.008	0.045	0.031	0.009	1.83	0.012	0.008	-
STDEV	0.013	0.0002	0.002	0.001	0.003	0.001	0.001	0.001	0.0001	0.011	0.0005	0.0005	-
RSD	0.34	0.29	1.11	5.93	0.67	6.47	2.65	4.25	1.23	0.57	3.73	5.39	-

CHILLED GREY IRON: CKD STANDARD 241

ELEMENT	C %	Cr %	Cu %	Mn %	Mo %	Ni %	P %	S %	Sb %	Si %	V %	Fe %
AVERAGE	1.71	0.67	0.020	0.13	0.63	0.014	0.005	0.13	0.13	3.20	0.090	93.28
CERT	1.71	0.68	0.021	0.14	0.60	0.014	0.006	0.13	0.13	3.20	0.092	-
STDEV	0.011	0.015	0.001	0.002	0.003	0.001	0.001	0.002	0.002	0.011	0.0005	-
RSD	0.61	2.22	5.71	1.76	0.52	4.82	9.62	1.50	1.67	0.34	0.55	-

NICKEL HARD CAST IRON: CKD STANDARD 253

ELEMENT	C %	Cr %	Cu %	Mg %	Mn %	Mo %	Ni %	P %	S %	Si %	Al %	Ti %	V %	Fe %
AVERAGE	2.45	2.85	0.30	0.040	0.73	0.010	23.16	0.065	0.009	2.28	0.032	0.004	0.020	68.05
CERT	2.45	2.92	0.29	0.038	0.74	0.010	23.60	0.060	0.008	2.28	0.035	0.005	0.020	-
STDEV	0.084	0.013	0.0005	0.0002	0.011	0.0003	0.13	0.001	0.001	0.010	0.0003	0.0004	0.0003	-
RSD	3.41	0.46	0.15	0.52	1.43	2.76	0.56	1.35	10.9	0.43	0.96	9.09	1.29	-

CHROME HARD CAST IRON: BAS STANDARD CRRM 5

ELEMENT	C %	Cr %	Cu %	Mn %	Mo %	Ni %	P %	S %	Si %	Fe %
AVERAGE	3.60	30.54	0.21	0.30	0.58	0.24	0.013	0.012	0.41	64.09
CERT	3.57	30.30	0.21	0.30	0.54	0.26	0.014	0.013	0.39	-
STDEV	0.003	0.051	0.0003	0.003	0.001	0.001	0.0003	0.0004	0.002	-
RSD	0.09	0.17	0.12	0.87	0.09	0.24	2.48	2.93	0.46	-

AS CAST GREY IRON: BRAMMER STANDARD BS21A-G

ELEMENT	C %	Cr %	Cu %	Mn %	Mo %	Ni %	P %	S %	Si %	V %	Ti %	Al %	Fe %
AVERAGE	3.87	0.10	0.23	1.18	0.19	0.20	0.076	0.016	1.56	0.016	0.015	0.021	92.53
CERT	3.83	0.10	0.23	1.18	0.19	0.19	0.070	0.018	1.56	0.016	0.014	0.020	-
STDEV	0.023	0.0003	0.0004	0.003	0.001	0.001	0.001	0.001	0.016	0.001	0.0003	0.0001	-
RSD	0.60	0.33	0.16	0.27	0.35	0.34	1.85	6.72	1.02	3.57	1.63	0.27	-

GDS500A

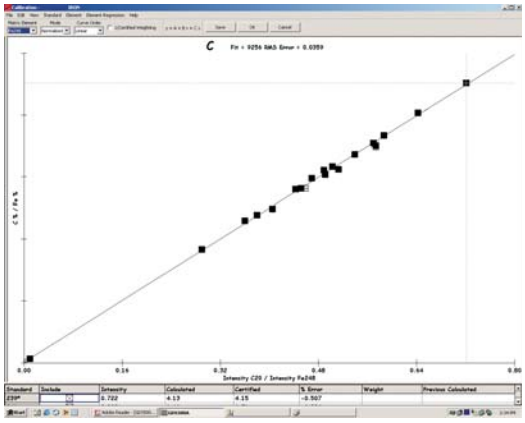
Sample Preparation

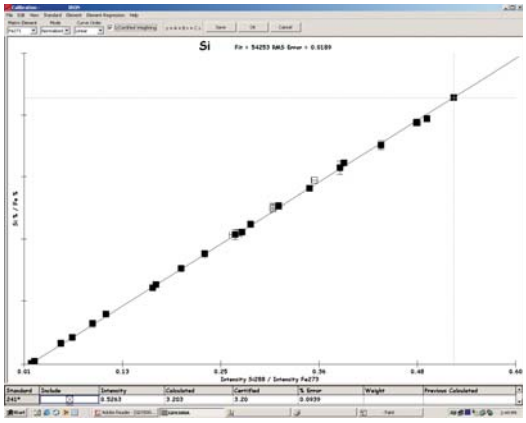
Chilled cast iron is prepared with a 120 grit zirconium oxide belt. As-cast samples are polished to a surface finish using 600 grit paper.

Accessories

Sample surface preparation: Belt Grinder (LECO BG) or polisher (LECO VP).

Calibration Curves





Calibration Standards

A factory-installed calibration is based upon customer requirements. Working curves are comprised of Certified Reference Materials (CRM's) and Reference Materials (RM's) from the following manufacturers: Brammer, CKD, CTIF, MBH, and LECO. Customer-supplied calibration pieces are useful to complement the calibration.

Drift Control of Calibration

Homogenous non-certified set-up standards (SUS's) are used to drift correct calibration curves. When necessitated by customer ranges or lack of suitable SUS material, RM's and CRM's can be substituted.

Analysis Times

The LECO GDS500A has the ability to perform multiple analyses without dropping the sample. This is possible due to the sputtering of material to reveal new untouched sample. Three analyses can be completed in a minute and a half when using the "Analyze all consecutive burns in the same spot" option in the software.

	Single Burn	Three Burns w/o Dropping	As-Cast Iron; Single Burn
Start-up and Pre-burn	60 sec.	60 sec.	180 sec.
Analyze	10 sec.	10 sec.	10 sec.
Analyze		10 sec.	
Analyze		10 sec.	
Total	**70 sec.**	**90 sec.**	**190 sec.**

Delivering the Right Results

LECO Corporation
3000 Lakeview Ave. • St. Joseph, MI 49085
Phone: 800-292-6141 • Fax: 269-982-8977
info@leco.com • www.leco.com • *ISO-9001:2000 No. FM 24045*

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