Spectroscopy Performance Note

Glow Discharge Atomic Emission Spectrometry and its Performance in Accordance with ASTM E415

Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Carbon and Low Alloy Steel

ASTM E415 sets the criteria for the routine control analysis of preliminary and ladle tests of steel manufacturing and analysis of processed materials. It is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores and Related Materials, and is the direct responsibility of Subcommittee E01.01 on Iron, Steel and Ferroalloys.

The method allows the use of alternate wavelengths and excitation sources, provided that it can be shown experimentally that equivalent precision and accuracy can be demonstrated. Extensive data is shown in Table 4* for variability of results within individual laboratories using NBS SRM1262. Although NBS SRM1262 is exhausted, NBS SRM1262b, which is the third bar of the original heat, is very similar to the original material in composition and morphology and has its own certification. NBS SRM 1262b was used as the test specimen in the LECO GDS Laboratory and is available for sale from NIST.

The following tables* show the individual averages of the seven cooperating laboratories. The value in brackets next to element name is the certified value in NBS SRM 1262. The standard deviation next to each labs value is the uncertainty of the average which that lab reported [n=3]. The SD & RSD of the grand mean is shown between the 2 parallel lines. The value in brackets next to GDS is the certified value for NBS SRM 1262b along with the published uncertainty. The SD & RSD of the grand mean by GDS is shown in the last line of each elemental determination [n=10].

The data clearly shows that glow discharge is a viable excitation source for atomic emission spectrometry by meeting the original statistical data.

**Corresponding to E415 Table 4: Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel; ASTM Annual Book of ASTM Standards; Section 3; Volume 03.05; 2006*

GDS

Pooled Data Using NBS1262; ASTM E415 • n=7
GDS Data Using 1262b • n=10

	%	SD	RSD
Al [0.095]	0.087	0.0032	
	0.0936	0.0047	
	0.0823	0.0083	
	0.0992	0.003	
	0.0999	0.0019	
	0.095	0.0015	
	0.0899	0.0012	
	0.092	0.0064	6.9
GDS [0.081±0.002]	0.086	0.0033	3.8
B [0.0025]	0.0026	0.0004	
	0.00174	0.00043	
	0.003	0.0003	
	0.00257	0.00009	
	0.00303	0.00014	
	0.00242	0.00007	
	0.0028	0.0001	
	0.0026	0.0004	16.9
GDS [0.0025±0.0001]	0.0027	0.0001	6.4
C [0.16]	0.16	0.008	
	0.164	0.0094	
	0.158	0.0046	
	0.162	0.0022	
	0.159	0.007	
	0.159	0.0037	
	0.162	0.0038	
	0.16	0.0021	1.3
GDS [0.160±0.01]	0.16	0.0011	0.7
Cr [0.30]	0.296	0.0048	
	0.30	0.0038	
	0.309	0.0039	
	0.302	0.0015	
	0.30	0.0032	
	0.304	0.0022	
	0.298	0.002	
	0.30	0.0042	1.4
GDS [0.30±0.01]	0.29	0.0014	0.5

	%	SD	RSD
Cu [0.50]	0.499	0.0116	
	0.502	0.0098	
	0.494	0.0212	
	0.505	0.00346	
	0.496	0.012	
	0.499	0.00852	
	0.534	0.0099	
	0.50	0.013	2.7
GDS [0.51±0.01]	0.51	0.004	0.8
Mn [1.04]	1.056	0.0092	
	1.00	0.0081	
	1.10	0.0143	
	1.05	0.0072	
	1.03	0.015	
	1.016	0.0117	
	1.038	0.0087	
	1.04	0.032	3.1
GDS [1.05±0.01]	1.05	0.0046	0.4
Mo [0.068]	0.068	0.0012	
	0.0681	0.004	
	0.0663	0.00173	
	0.069	0.00064	
	0.068	0.011	
	0.069	0.00068	
	0.0645	0.0005	
	0.068	0.0016	2.4
GDS [0.070±0.001]	0.072	0.0011	1.5
Ni [0.59]	No value		
	0.597	0.0078	
	0.56	0.0069	
	0.589	0.0022	
	0.606	0.0097	
	0.589	0.00443	
	0.556	0.0027	
	0.58	0.0202	3.5
GDS [0.59±0.01]	0.61	0.0049	0.8

Pooled Data Using NBS1262; ASTM E415 • n=7
500a Data Using 1262b • n=10

	%	SD	RSD
P [0.042]	0.0414	0.0022	
	0.0355	0.00144	
	0.0414	0.0012	
	0.0394	0.00039	
	0.04	0.0014	
	0.0369	0.00063	
	0.0342	0.0004	
	0.038	0.0028	7.5
GDS [0.044±0.001]	0.044	0.00095	2.2
Si [0.39]	0.403	0.0046	
	0.392	0.0058	
	0.393	0.0126	
	0.398	0.003	
	0.389	0.0059	
	0.437	0.0032	
	No value		
	0.40	0.018	4.4
GDS [0.40±0.01]	0.39	0.005	1.3
S [0.038]	0.0376	0.002	
	0.0404	0.00239	
	0.0363	0.00118	
	0.0387	0.00103	
	0.0392	0.0014	
	0.0376	0.00132	
	0.0375	0.0014	
	0.038	0.0013	3.5
GDS [0.037±0.001]	0.037	0.0011	2.9
V [0.041]	0.04	0.00037	
	0.0402	0.00057	
	0.041	0.001	
	0.0413	0.00022	
	0.0387	0.0005	
	0.039	0.00036	
	0.0458	0.0004	
	0.041	0.0024	5.8
GDS [0.041±0.001]	0.038	0.00067	1.8

	%	SD	RSD
Co [0.30]	0.299	0.0054	
	0.302	0.0044	
	0.252	0.0137	
	0.304	0.002	
	No value		
	0.299	0.00597	
	0.3038	0.0029	
	0.29	0.020	6.9
GDS [0.30±0.01]	0.30	0.0047	1.5
Nb [0.29]	0.29	0.012	
	0.292	0.0108	
	0.321	0.0098	
	0.292	0.0037	
	0.289	0.0137	
	0.283	0.0059	
	0.2636	0.0042	
	0.29	0.017	5.8
GDS [0.30±0.01]	0.31	0.012	3.9
Ti [0.084]	0.079	0.0043	
	0.089	0.0025	
	0.0899	0.000324	
	0.091	0.0011	
	0.0882	0.0005	
	0.085	0.00135	
	0.1073	0.0017	
	0.089	0.0086	9.6
GDS [0.10±0.004]	0.10	0.0013	1.3
Zr [0.19]	0.192	0.0089	
	No value		
	0.305	0.0177	
	0.187	0.0048	
	0.191	0.0081	
	0.173	0.00495	
	0.1941	0.007	
	0.21	0.0495	23.5
GDS [0.22±0.01]	0.21	0.0095	4.5

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