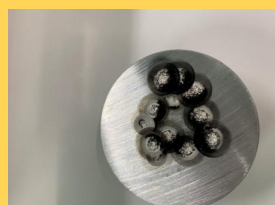
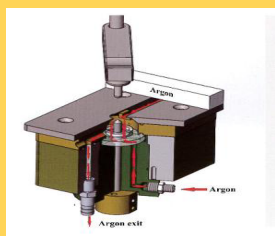




**PG SPARK**

**CCD METAL ANALYSER**

DETAILED OVERVIEW



Analytical  
Instruments  
for  
Science

# pg SPARK

## CCD Metal Analyser

The **PG Spark CCD Metal Detector** is widely used for quality control in the production process and finished product in the metallurgical fields of casting, machinery and metal processing. PG Spark can be used for chemical composition analysis of Ferrous, Aluminium, Copper, Nickel, Cobalt, Magnesium, Titanium, Zinc, Lead, Silver and other metal alloys.



### Overview

PG Spark CCD Optical Emission Spectrometer uses a high-resolution linear CCD to perform full-spectrum scanning from 130-900nm. The PG Spark also benefits from an intelligent argon controlled flushed spectrometer chamber system thus ensuring maximum stability for long periods of analysis and the use of analytical wavelengths unconstrained. This includes analysis for elements such as **Carbon, Nitrogen, Sulphur, Arsenic, Boron and Phosphorus** at ultra-low levels.



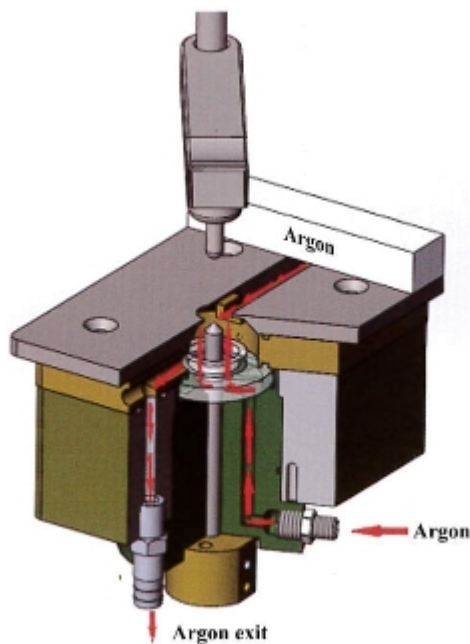
### Key Applications

- Large Steel Plants where needs are at about 10ppm for elements such as C, N, Cr, S, P
- Pure Metal applications for purity of metals such as Al, Cu, Pb, Zn, Mg, Ti etc.
- Testing Laboratories, Commercial testing Labs, Small Foundries etc.
- Regulatory compliance for very low limits of detection such as Pb, As, Cd.
- Foundries which need a fast, accurate and precise analysis from materials in the production furnaces.
- Analysis of non ferrous alloys such as Aluminium. Copper, Lead, Tin, Titanium, Silver etc.
- Warehouse material identification
- Manufacturing facilities.

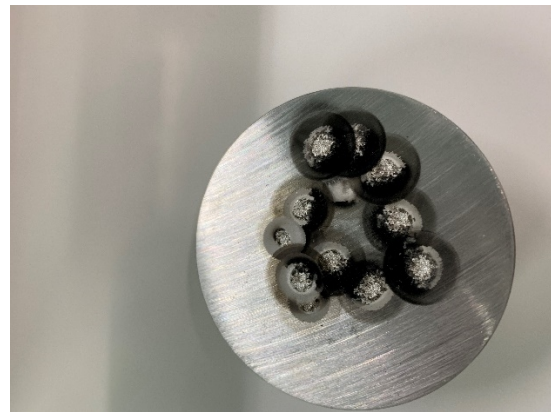
## Spark Stand

The spark stand will take a maximum weight of 50Kg of sample. The Spark Stand has been specifically designed coaxial stand with an optimised internal gas circuit which greatly reduces argon consumption. The sample cavity is cleaned by a Self Purging Function

### Schematic Drawing of Spark Stand and a series of sparks on a steel sample.



Spark Stand Schematic



Steel Sample showing a several Sparks.

### Spark Excitation Source

- Discharge Parameters protected by Passwords.
- Maximum Discharge Frequency – 1000Hz.
- Maximum time before adjustment is 5000 hours
- Self-purging function that keeps the cavity clean.
- Newly designed co-axial spark stand with an optimised internal gas circuit which greatly reduces argon consumption.

## ANALYSIS RANGES ACHIEVABLE BY THE PG SPARK OES IN VARIOUS MATERIALS

ELEMENTS FOR Fe BASED MATERIALS	RANGE %	ELEMENTS FOR Al BASED MATERIALS	RANGE %	ELEMENTS FOR Cu BASED MATERIALS	RANGE %
C	0.0015-4.5	Cd	0.001-0.05	Al	0.005-11.2
Si	0.0017-6.0	Cr	0.001-0.5	As	0.005-0.4
Mn	0.0007-25	Cu	0.001-21	Be	0.1-3.5
P	0.0018-1.5	Fe	0.001-2.25	Bi	0.005-0.1
S	0.003-0.4	Mg	0.001-15	Cd	0.0005-0.05
Cr	0.005-40	Mn	0.001-7	Co	0.0005-0.2
Ni	0.005-40	Ni	0.001-3	Fe	0.005-6.1
Mo	0.001-11	P	0.001-0.02	Mg	0.005-0.065
Cu	0.005-10	Pb	0.001-1.1	Mn	0.005-6
W	0.006-25	Si	0.001-27	Ni	0.005-35
V	0.005-10	Sn	0.001-0.35	P	0.005-0.1
Ti	0.003-2.0	Ti	0.001-0.5	Pb	0.005-10
Nb	0.006-3	Zn	0.001-11	S	0.0005-0.1
Al	0.004-6	Sb	0.005-0.5	Sb	0.005-0.5
Mg	0.001-0.15	Sr	0.005-0.1	Si	0.005-5
Ce	0.003-0.2	V	0.005-0.3	Sn	0.005-12
Zr	0.001-0.5	Zr	0.001-0.5	Ti	0.005-0.3
Co	0.001-13	Ag	0.005-0.8	Zn	0.005-40
B	0.003-0.1	As	0.003-0.05	Cr	0.005-0.1
La	0.003-0.1	B	0.001-0.015	Zr	0.005-0.01
As	0.001-0.2	Be	0.001-0.2	Te	0.0005-0.1
Pb	0.001-0.4	Ca	0.005-0.2	Se	0.0005-0.1
Sn	0.001-0.3	Ce	0.005-0.2	In	0.005-0.1
Sb	0.005-0.2	Ga	0.005-0.1	C	0.005-0.05
Bi	0.001-0.2	Co	0.005-0.57	B	0.005-0.02
Ca	0.001-0.01	Li	0.005-0.05	Au	0.005-0.1
Zn	0.001-0.05	Na	0.005-0.02	Ag	0.005-0.1
Se	0.003-0.4	Al	REF	Cu	REF
N	0.05-1.0				
Fe	REF				

## Detailed Specifications

### Optical System

- Paschen Runge Mounted Spectrometer
- Spectral Range 130-800nm
- Focal length of Spectrometer is 500mm
- Holographic Grating with 2700 lines/mm (Elements such as N, Li, Na and K can be analysed)
- Dispersion in the first order is 0.74nm/mm and 0.37nm/mm in the second order
- Resolution: 0.005926nm
- Not limited by elemental channels
- Detector with multiple CCD's
- Spectrometer uses a constant temperature system with a control accuracy of  $\pm 0.1^{\circ}\text{C}$

## CCD Detector

- High Resolution CCD Detector
- 3648 single chip CCD Pixels
- Single Pixel size of 8µm



**Spectrometer Layout with CCD and Channel Electronics.**

## Programmable Control Argon-Flushes Spectrometer Chamber

- The Spectrometer Optical Chamber is a NEW optical chamber with an extremely low thermal expansion coefficient which provides high instrument stability.
- The argon flush to the Spectrometer chamber is programmed and controlled via the software.
- The warm-up time for a 'cold' machine which has been shut down for 12 hours or more is ONLY 30 minutes. For a system in operation the start time is 5 minutes or less.

## Argon Consumption

- Argon Flow Rate during analysis is under 8 litres/minute
- Argon Flow during standby is 60ml/min
- The flow, pressure and the rate of flow are all programmed via the software

## Software

- Calculation of the same element in different matrices using stored calibrations.
- Material Identification
- Support automatic calculation functions such as Carbon Equivalent.
- NET based port data acquisition' means communication between OES readout system and control pf PC via Ethernet TCP/IP ?
- Re-calibration by 1 single sample possible.

## Basic Parameters of the PG Spark CCD-OES Spectrometer

Power Supply	220v $\pm$ 10%, single phase 16A 2.5KVA
Outline Dimensions	840L x 470W x 440H
Weight	Approx. 80Kg
Operating Environment	Temperature 10-50°C Humidity less than 75%
Argon Purity	$\geq 99.999\%$



## EXAMPLE OF STABILITY FOR THE ANALYSIS OF ALUMINIUM ALLOYS OVER 10 ANALYTICAL DETERMINATIONS

	Ave	ASD	RSD	1	2	3	4	5	6	7	8	9	10
Cd (%)	0.002	0.000	1.132	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cr (%)	0.090	0.000	0.483	0.090	0.090	0.090	0.089	0.089	0.090	0.090	0.090	0.090	0.090
Cu (%)	1.362	0.008	0.551	1.356	1.359	1.368	1.376	1.369	1.362	1.362	1.355	1.354	1.354
Fe (%)	0.942	0.005	0.481	0.939	0.942	0.948	0.951	0.946	0.940	0.941	0.938	0.939	0.937
Mn (%)	0.172	0.001	0.306	0.171	0.172	0.172	0.173	0.172	0.172	0.172	0.171	0.171	0.172
Ni (%)	1.263	0.002	0.162	1.261	1.263	1.264	1.266	1.262	1.263	1.265	1.265	1.258	1.263
P (%)	0.012	0.001	5.427	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.011	0.013	0.012
Pb (%)	0.072	0.001	2.037	0.072	0.074	0.071	0.070	0.071	0.073	0.072	0.074	0.074	0.071
Sn (%)	0.064	0.001	1.061	0.064	0.064	0.065	0.066	0.065	0.064	0.064	0.064	0.064	0.065
Ti (%)	0.096	0.000	0.146	0.096	0.095	0.096	0.096	0.096	0.096	0.096	0.096	0.095	0.096
Sb (%)	0.036	0.001	4.078	0.035	0.036	0.036	0.038	0.035	0.037	0.036	0.034	0.034	0.038
Se (%)	0.003	0.001	24.192	0.003	0.005	0.003	0.004	0.003	0.003	0.003	0.004	0.003	0.002
Zr (%)	0.019	0.001	3.650	0.018	0.018	0.018	0.020	0.018	0.018	0.018	0.019	0.019	0.019
Be (%)	0.002	0.000	1.431	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Ca (%)	0.004	0.000	3.632	0.004	0.004	0.004	0.005	0.004	0.004	0.004	0.004	0.004	0.004
Zn (%)	0.497	0.005	0.976	0.495	0.493	0.500	0.500	0.494	0.494	0.504	0.494	0.504	0.490
Mg (%)	2.298	0.015	0.651	2.286	2.305	2.280	2.314	2.313	2.313	2.285	2.286	2.286	2.316
Si (%)	8.849	0.032	0.365	8.839	8.893	8.810	8.871	8.861	8.872	8.802	8.843	8.814	8.884
Al	84.218	0.048	0.057	84.255	84.172	84.260	84.144	84.184	84.183	84.272	84.248	84.272	84.184

## EXAMPLE OF STABILITY FOR THE ANALYSIS OF ALUMINIUM ALLOYS OVER 22 ANALYTICAL DETERMINATIONS

	Ave	ASD	RSD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Si (%)	8.7910	0.0343	0.3898	8.8232	8.8567	8.8286	8.7788	8.7732	8.7543	8.7778	8.8029	8.7516	8.7860	8.7948	8.8030	8.7612	8.8047	8.7331	8.7404	8.8137	8.7261	8.8046	8.7984	8.8087	8.8077
Fe (%)	0.9003	0.0047	0.5234	0.9056	0.9044	0.9075	0.9009	0.9086	0.9069	0.8989	0.9053	0.9055	0.8991	0.9002	0.9031	0.9013	0.8990	0.9020	0.8905	0.8977	0.8951	0.8957	0.8976	0.8965	0.8943
Mg (%)	2.3003	0.0082	0.3554	2.2936	2.2916	2.2930	2.2921	2.2827	2.2887	2.3059	2.2958	2.3003	2.3045	2.2916	2.3073	2.3000	2.3029	2.3012	2.3107	2.3029	2.3109	2.2994	2.2991	2.3204	2.3041
Se (%)	0.0036	0.0012	34.2581	0.0009	0.0035	0.0033	0.0037	0.0038	0.0044	0.0046	0.0037	0.0035	0.0024	0.0044	0.0044	0.0034	0.0040	0.0022	0.0063	0.0039	0.0021	0.0040	0.0054	0.0050	0.0050
Ti (%)	0.0983	0.0004	0.3767	0.0981	0.0987	0.0987	0.0990	0.0991	0.0988	0.0981	0.0987	0.0986	0.0985	0.0985	0.0981	0.0981	0.0982	0.0984	0.0979	0.0978	0.0980	0.0977	0.0982	0.0982	0.0981
Mn (%)	0.1635	0.0008	0.4882	0.1654	0.1643	0.1650	0.1638	0.1647	0.1639	0.1637	0.1646	0.1631	0.1637	0.1631	0.1624	0.1625	0.1626	0.1635	0.1627	0.1628	0.1628	0.1637	0.1628	0.1630	0.1630
Si (%)	1.1204	0.0027	0.2384	1.1185	1.1227	1.1211	1.1222	1.1214	1.1205	1.1161	1.1187	1.1238	1.1206	1.1254	1.1214	1.1212	1.1225	1.1218	1.1177	1.1191	1.1231	1.1166	1.1236	1.1224	1.1171
P (%)	0.0074	0.0008	10.1341	0.0084	0.0082	0.0078	0.0071	0.0085	0.0059	0.0072	0.0075	0.0057	0.0065	0.0072	0.0067	0.0068	0.0073	0.0065	0.0078	0.0075	0.0074	0.0077	0.0076	0.0081	0.0082
Pb (%)	0.0974	0.0013	1.3816	0.0951	0.0961	0.0953	0.0966	0.0949	0.0975	0.0996	0.0972	0.0967	0.0975	0.0961	0.1001	0.0988	0.0981	0.0986	0.0983	0.0972	0.0958	0.0981	0.0979	0.0981	0.0979
Sn (%)	0.0710	0.0009	1.3988	0.0722	0.0726	0.0725	0.0713	0.0723	0.0719	0.0713	0.0725	0.0711	0.0708	0.0711	0.0706	0.0701	0.0703	0.0695	0.0704	0.0697	0.0712	0.0699	0.0705	0.0711	0.0711
Zn (%)	0.5250	0.0053	1.0169	0.5226	0.5163	0.5229	0.5169	0.5199	0.5230	0.5181	0.5177	0.5235	0.5234	0.5327	0.5169	0.5250	0.5301	0.5251	0.5297	0.5262	0.5265	0.5322	0.5329	0.5328	0.5259
Sb (%)	0.0126	0.0041	33.0119	0.0169	0.0162	0.0173	0.0145	0.0214	0.0120	0.0155	0.0210	0.0111	0.0112	0.0128	0.0101	0.0086	0.0099	0.0097	0.0068	0.0116	0.0061	0.0125	0.0064	0.0089	0.0175
V (%)	0.0157	0.0002	1.2134	0.0154	0.0156	0.0159	0.0159	0.0161	0.0158	0.0155	0.0160	0.0158	0.0155	0.0159	0.0155	0.0155	0.0158	0.0156	0.0157	0.0155	0.0155	0.0155	0.0157	0.0160	0.0158
Zr (%)	0.0175	0.0008	4.7887	0.0159	0.0168	0.0172	0.0169	0.0179	0.0176	0.0162	0.0187	0.0176	0.0172	0.0179	0.0161	0.0169	0.0179	0.0163	0.0172	0.0171	0.0181	0.0186	0.0188	0.0187	0.0181
Ag (%)	0.0061	0.0000	0.6070	0.0060	0.0061	0.0061	0.0060	0.0060	0.0061	0.0062	0.0061	0.0060	0.0060	0.0060	0.0060	0.0060	0.0061	0.0061	0.0060	0.0061	0.0061	0.0061	0.0061	0.0060	0.0061
Au (%)	0.0091	0.0001	1.4826	0.0092	0.0091	0.0091	0.0091	0.0093	0.0091	0.0091	0.0092	0.0088	0.0090	0.0089	0.0089	0.0090	0.0090	0.0090	0.0090	0.0091	0.0088	0.0091	0.0091	0.0091	0.0092
B (%)	0.0058	0.0001	1.3940	0.0059	0.0059	0.0059	0.0059	0.0060	0.0058	0.0059	0.0059	0.0057	0.0057	0.0059	0.0058	0.0058	0.0057	0.0058	0.0058	0.0058	0.0057	0.0059	0.0057	0.0058	0.0059
Be (%)	0.0006	0.0000	5.0778	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Ca (%)	0.0051	0.0001	2.7655	0.0047	0.0051	0.0051	0.0051	0.0052	0.0051	0.0049	0.0053	0.0051	0.0051	0.0052	0.0052	0.0049	0.0051	0.0050	0.0050	0.0049	0.0051	0.0051	0.0051	0.0054	0.0054
Cu (%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga (%)	0.0107	0.0001	0.9488	0.0108	0.0105	0.0107	0.0107	0.0107	0.0108	0.0110	0.0107	0.0108	0.0107	0.0108	0.0108	0.0108	0.0107	0.0108	0.0109	0.0106	0.0106	0.0108	0.0108	0.0107	0.0102
Co (%)	0.0154	0.0001	0.7842	0.0153	0.0154	0.0154	0.0154	0.0153	0.0153	0.0156	0.0152	0.0153	0.0154	0.0156	0.0153	0.0154	0.0153	0.0154	0.0150	0.0153	0.0152	0.0153	0.0152	0.0153	0.0154
Na (%)	0.00167	0.00027	16.37600	0.00182	0.00138	0.00173	0.00170	0.00147	0.00208	0.00189	0.00188	0.00224	0.00199	0.00200	0.00196	0.00176	0.00141	0.00186	0.00131	0.00131	0.00179	0.00143	0.00135	0.00150	0.00143
Li (%)	0.00063	0.00002	3.28916	0.00066	0.00059	0.00064	0.00063	0.00062	0.00065	0.00066	0.00064	0.00067	0.00065	0.00065	0.00065	0.00063	0.00062	0.00068	0.00063	0.00062	0.00064	0.00062	0.00061	0.00061	0.00062
Cr (%)	0.0011	0.0000	2.3121	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0012	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0012	0.0011	0.0011	0.0012	0.0012	0.0011	0.0011	0.0012
Cr (%)	0.0884	0.0004	0.4682	0.0877	0.0884	0.0883	0.0891	0.0882	0.0884	0.0885	0.0881	0.0885	0.0887	0.0884	0.0892	0.0885	0.0883	0.0894	0.0883	0.0879	0.0886	0.0876	0.0884	0.0887	0.0884
Cu (%)	1.3859	0.0085	0.6168	1.4006	1.3899	1.3974	1.3903	1.3950	1.3899	1.3937	1.3931	1.3965	1.3966	1.3870	1.3801	1.3795	1.3770	1.3775	1.3829	1.3781	1.3749	1.3826	1.3785	1.3771	1.3771
Al	84.3456	0.0362	0.0429	84.3039	84.2822	84.2919	84.3647	84.3561	84.3759	84.3562	84.3212	84.3719	84.3327	84.3266	84.3318	84.3861	84.3336	84.4131	84.4075	84.3293	84.4179	84.3446	84.3408	84.3194	84.3346

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