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Premium Certified Reference Material
RRM Fe-108

PRODUCT: IRON ORE
Pilbara Region Western Australian
CERTIFICATE OF ANALYSIS

Certificate Number: RRM CRM Fe-108 Rev 1 — Date: 23rd May 2023

Table 1 ***Fe-108 Constituents (ISO 2596:2006 Hygroscopic Moisture Corrected)***

Analyte (Unit)	Assigned value	Standard Deviation		95% Confidence Limits		Number of Laboratories	Number of Analyses	Mean of number of analyses per Laboratory
		Within Laboratory	Between Laboratory	Lower	Upper			
Fe (%)	52,78	0,25	0,27	52,68	52,88	12	49	4,1
Fe calculated (%)	52,75	0,13	0,15	52,70	52,81	12	49	4,1
SiO_2 (%)	11,99	0,13	0,16	11,93	12,05	12	49	4,1
Al_2O_3 (%)	3,09	0,05	0,05	3,07	3,10	12	49	4,1
TiO_2 (%)	0,193	0,004	0,006	0,191	0,196	12	49	4,1
Mn (%)	0,134	0,003	0,003	0,133	0,135	11	43	3,9
CaO (%)	0,067	0,006	0,007	0,064	0,069	12	49	4,1
MgO (%)	0,175	0,009	0,011	0,171	0,180	12	49	4,1
K_2O (%)	0,032	0,001	0,002	0,032	0,033	12	49	4,1
Na_2O (%)	0,023	0,008	0,018	0,012	0,034	11	44	4,0
P (%)	0,042	0,001	0,001	0,042	0,043	12	49	4,1
S (%)	0,021	0,001	0,002	0,020	0,022	11	45	4,1
LOI-371 %	7,52	0,05	0,09	7,44	7,60	4	30	7,5
LOI-425 %	7,79	0,04	0,05	7,76	7,81	10	54	5,4
LOI-650 %	8,38	0,05	0,07	8,34	8,41	10	54	5,4
LOI-1000 %	8,55	0,07	0,09	8,52	8,58	15	77	5,1
As (%)	0,014	0,001	0,004	0,011	0,016	11	41	3,7
Cl (%)	0,004	0,001	0,002	0,003	0,005	10	42	4,2
Co (%)	0,001	0,001	0,001	-	0,001	10	42	4,2
Cu (%)	0,001	0,001	0,001	-	0,001	10	42	4,2
Pb (%)	0,004	0,001	0,003	0,003	0,006	11	44	4,0
Zn (%)	0,007	0,001	0,001	0,006	0,007	9	35	3,9
Ba (%)	0,002	0,002	0,002	0,001	0,003	9	42	4,7
Cr (%)	0,009	0,002	0,002	0,008	0,010	10	42	4,2
Ni (%)	0,003	0,003	0,003	0,002	0,003	11	43	3,9
Sn (%)	0,001	0,001	0,001	-	0,001	9	38	4,2
Sr (%)	-	-	-	-	-	9	42	4,7
V (%)	0,003	0,001	0,001	0,002	0,003	10	41	4,1
Zr (%)	0,019	0,001	0,002	0,018	0,020	10	35	3,5

Table 2 ***Fe-108 Constituents (non-hygroscopically moisture corrected)***

Analyte (Unit)	Assigned value	Standard Deviation		95% Confidence Limits		Number of Laboratories	Number of Analyses	Mean of number of analyses per Laboratory
		Within Laboratory	Between Laboratory	Lower	Upper			
Fe (%)	52,66	0,11	0,15	52,60	52,72	16	64	4,0
Fe calculated (%)	52,63	0,06	0,11	52,58	52,67	16	64	4,0
SiO_2 (%)	11,82	0,06	0,20	11,72	11,92	16	64	4,0
Al_2O_3 (%)	3,05	0,02	0,04	3,03	3,06	16	64	4,0
TiO_2 (%)	0,194	0,003	0,004	0,193	0,196	14	56	4,0
Mn (%)	0,133	0,001	0,002	0,132	0,135	14	56	4,0
CaO (%)	0,063	0,003	0,006	0,060	0,066	14	56	4,0
MgO (%)	0,172	0,009	0,021	0,161	0,184	14	56	4,0
K_2O (%)	0,031	0,001	0,002	0,031	0,032	14	56	4,0
Na_2O (%)	0,012	0,007	0,009	0,007	0,016	10	41	4,1
P (%)	0,043	0,001	0,001	0,042	0,043	16	64	4,0
S (%)	0,021	0,001	0,003	0,019	0,022	15	60	4,0
LOI-371 %	7,81	0,05	0,16	7,71	7,92	10	56	5,6
LOI-425 %	8,14	0,07	0,07	8,12	8,17	6	37	6,2
LOI-650 %	8,67	0,06	0,13	8,60	8,75	11	60	5,5
LOI-1000 %	8,82	0,08	0,35	8,66	8,98	19	92	4,8
As (%)	0,014	0,001	0,002	0,013	0,015	8	35	4,4
Cl (%)	0,006	0,002	0,004	0,004	0,008	9	39	4,3
Co (%)	0,001	0,001	0,001	-	-	4	16	4,0
Cu (%)	0,001	0,001	0,001	0,001	0,002	9	37	4,1
Pb (%)	0,005	0,001	0,002	0,004	0,006	9	37	4,1
Zn (%)	0,009	0,001	0,001	0,007	0,012	8	30	3,8
Ba (%)	-	-	-	-	-	4	19	4,8
Cr (%)	0,011	0,001	0,001	0,010	0,011	5	15	3,0
Ni (%)	0,004	0,001	0,002	0,004	0,005	5	18	3,6
Sn (%)	0,002	0,001	0,004	-	0,007	3	12	4,0
Sr (%)	0,001	0,001	0,002	-	0,003	3	12	4,0
V (%)	0,003	0,001	0,002	0,002	0,005	5	18	3,6
Zr (%)	0,021	0,001	0,002	0,018	0,023	3	12	4,0

Introduction:

Certified Reference Materials (CRMs) are used by laboratories to prove the value of their service offerings and for clients of laboratories to evaluate and monitor laboratory performance. CRMs must comply with high metrological requirements and ensuring traceability of measurement results.

Since most techniques employing analytical instrumentation are comparative, these techniques require a sample of known composition (CRM) for accurate calibration. Grade and Matrix matched CRM's are thus vital to the core of the analytical chemistry industry.

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Preparation of Material:

The material constituting RRM Fe-108 has been according to ISO 17034:2016, and includes the following:

- Drying to constant mass
- Crushing and dry milling to nominal 53µm particle size
- Homogenization
- Systematic rotary division of the entire lot, to final aliquot
- Packaging
- Rotary divided to nominal 250g sealed jars
- Rotary divided to nominal 10g geochem pouches, vacuum sealed in barrier foil
- Custom package sizes available on request

Unique to RRM, rotary division of all material to final packaging.

Methods of Analysis:

The analysis of the test samples has been conducted according to each individual laboratory's routine analytical procedures. The material has been dried at 105°C until constant mass was achieved, or corrected for moisture according to ISO 2596:2006. Each test sample has been prepared, analyzed and reported in duplicate; with results reported on a dry basis.

Elements and Oxides determined as follows:

- Multi-element Iron Ore Suite – XRF fused disc analysis
- Loss on Ignition – Thermo Gravimetric Analysis

Homogeneity Evaluation:

For the evaluation of the homogeneity of the Fe-108 material, 14 samples were selected throughout the batch for analysis in duplicate. ANOVA (one-way analysis of variance) was used to assess the homogeneity for measured Iron and total Loss on Ignition. No significant variation was observed for both 'batch' and 'within unit' exercises. The results and statistical evaluation from the interlaboratory studies (presented in Tables 3, 4, 5 and 6) further validate the homogeneity. The material can thus be considered fit for purpose for use as a CRM.

Statistical Evaluation:

We have grouped the laboratories according to the method of determining moisture. Certain laboratories determine the dry weight of iron ore samples at 105°C, whilst some use the ISO 2596:2006 correction for hygroscopic moisture. Some iron ore types report different moisture values for each of these methods, which in turn influences the chemical analysis as the determined moisture content has an influence on the dry starting mass.

A comprehensive statistical evaluation of the results received from the various laboratories was performed. Outliers were identified and removed from the data sets for the certification exercise.

The assigned values are the mean of means after removal of outliers. All constituents reported with a between laboratory % RSD of <5% are regarded as certified values.

Table 3 *Fe-108 Statistical Evaluation (Hygroscopic Moisture Corrected)*

Analyte (Unit)	Fe (%)	Fe calc (%)	SiO_2 (%)	Al_2O_3 (%)	TiO_2 (%)	Mn (%)	CaO (%)
Assigned value	52.78	52.75	11.99	3.09	0.193	0.134	0.067
Number of Laboratories	12	12	12	12	12	11	12
Number of Analyses	49	49	49	49	49	43	49
Between Laboratory Standard Deviation	0.27	0.15	0.16	0.5	0.006	0.003	0.007
Within Laboratory Standard Deviation	0.25	0.13	0.1293	0.05	0.004	0.003	0.006
Between Laboratory Relative Standard Deviation	0.51 %	0.29 %	1.30 %	1.53 %	2.94 %	2.59 %	10.7 %
Within Laboratory Relative Standard Deviation	0.47 %	0.25 %	1.07 %	1.51 %	1.96 %	2.59 %	9.60 %
Standard Uncertainty	0.049	0.028	0.031	0.007	0.001	0.001	0.001
Lower confidence limit	52.68	52.70	11.93	3.07	0.191	0.133	0.064
Upper confidence limit	52.88	52.81	12.05	3.10	0.196	0.135	0.069
Lower limit of tolerance	52.23	52.45	11.68	2.99	0.182	0.127	0.052
Upper limit of tolerance	53.32	53.06	12.30	3.18	0.205	0.141	0.081

Analyte (Unit)	P (%)	S (%)	MgO (%)	K_2O (%)	Na_2O (%)	As (%)	Cl (%)
Assigned value	0.042	0.021	0.175	0.032	0.023	0.014	0.004
Number of Laboratories	12	11	12	12	11	11	10
Number of Analyses	49	45	49	49	44	41	42
Between Laboratory Standard Deviation	0.001	0.002	0.011	0.002	0.018	0.004	0.002
Within Laboratory Standard Deviation	0.001	0.001	0.009	0.001	0.008	0.001	0.001
Between Laboratory Relative Standard Deviation	2.72 %	7.74 %	6.13 %	4.92 %	80 %	30 %	51 %
Within Laboratory Relative Standard Deviation	2.72 %	5.02 %	5.00 %	4.27 %	35 %	7.99 %	35 %
Standard Uncertainty	-	-	0.002	-	0.005	0.001	0.001
Lower confidence limit	0.042	0.020	0.171	0.032	0.012	0.011	0.003
Upper confidence limit	0.043	0.022	0.180	0.033	0.034	0.016	0.005
Lower limit of tolerance	0.040	0.018	0.154	0.029	-	0.005	-
Upper limit of tolerance	0.045	0.024	0.197	0.035	0.059	0.022	0.009

Analyte (Unit)	Co (%)	Cu (%)	Pb (%)	Zn (%)	Ba (%)	Cr (%)	Ni (%)
Assigned value	0.001	0.001	0.004	0.007	0.002	0.009	0.003
Number of Laboratories	10	10	11	9	9	10	11
Number of Analyses	42	42	44	35	42	42	43
Between Laboratory Standard Deviation	0.001	0.001	0.003	0.001	0.002	0.002	0.003
Within Laboratory Standard Deviation	0.001	0.001	0.001	0.001	0.002	0.002	0.003
Between Laboratory Relative Standard Deviation	116 %	142 %	68 %	15.1 %	129 %	21 %	105 %
Within Laboratory Relative Standard Deviation	66 %	114 %	33 %	8.39 %	93 %	17.2 %	105 %
Standard Uncertainty	-	-	0.001	-	0.001	-	-
Lower confidence limit	-	-	0.003	0.006	0.001	0.008	0.002

Upper confidence limit	0.001	0.001	0.006	0.007	0.003	0.010	0.003
Lower limit of tolerance	-	-	-	0.005	-	0.005	-
Upper limit of tolerance	0.003	0.002	0.010	0.009	0.006	0.013	0.008

Analyte (Unit)	**Sn (%)**	**Sr (%)**	**V (%)**	**Zr (%)**
Assigned value	0.001	-	0.003	0.019
Number of Laboratories	9	9	10	10
Number of Analyses	38	42	41	35
Between Laboratory Standard Deviation	0.001	-	0.001	0.002
Within Laboratory Standard Deviation	0.001	-	0.001	0.001
Between Laboratory Relative Standard Deviation	191 %	-	46 %	10.8 %
Within Laboratory Relative Standard Deviation	185 %	-	27 %	3.47 %
Standard Uncertainty	-	-	-	0.001
Lower confidence limit	-	-	0.002	0.018
Upper confidence limit	0.001	-	0.003	0.020
Lower limit of tolerance	-	-	-	0.015
Upper limit of tolerance	0.003	-	0.005	0.023

Table 4 *Fe-108 Statistical Evaluation (non-hygroscopically moisture corrected)*

Analyte (Unit)	**Fe (%)**	**Fe calc (%)**	**SiO_2 (%)**	**Al_2O_3 (%)**	**TiO_2 (%)**	**Mn (%)**	**CaO (%)**
Assigned value	52.66	52.63	11.82	3.05	0.194	0.133	0.063
Number of Laboratories	16	16	16	16	14	14	14
Number of Analyses	64	64	64	64	56	56	56
Between Laboratory Standard Deviation	0.15	0.11	0.20	0.04	0.004	0.002	0.006
Within Laboratory Standard Deviation	0.11	0.06	0.06	0.02	0.003	0.001	0.003
Between Laboratory Relative Standard Deviation	0.28 %	0.21 %	1.71 %	1.19 %	2.07 %	1.80 %	9.41 %
Within Laboratory Relative Standard Deviation	0.20 %	0.12 %	0.47 %	0.68 %	1.63 %	0.98 %	4.13 %
Standard Uncertainty	0.029	0.024	0.049	0.008	0.001	0.001	0.002
Lower confidence limit	52.60	52.58	11.72	3.03	0.193	0.132	0.060
Upper confidence limit	52.72	52.67	11.92	3.06	0.196	0.135	0.066
Lower limit of tolerance	52.37	52.41	11.41	2.97	0.186	0.129	0.051
Upper limit of tolerance	52.96	52.84	12.22	3.12	0.202	0.138	0.075

Analyte (Unit)	**P (%)**	**S (%)**	**MgO (%)**	**K_2O (%)**	**Na_2O (%)**	**As (%)**	**Cl (%)**
Assigned value	0.043	0.021	0.172	0.031	0.012	0.014	0.006
Number of Laboratories	16	15	14	14	10	8	9
Number of Analyses	64	60	56	56	41	35	39
Between Laboratory Standard Deviation	0.001	0.003	0.021	0.002	0.009	0.002	0.004

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Within Laboratory Standard Deviation	0.001	0.001	0.009	0.001	0.007	0.001	0.002
Between Laboratory Relative Standard Deviation	3.07 %	15.4 %	12.0 %	4.79 %	79 %	11.9 %	60 %
Within Laboratory Relative Standard Deviation	2.52 %	4.69 %	4.94 %	2.33 %	59 %	6.13 %	27 %
Standard Uncertainty	-	0.001	0.006	-	0.002	0.001	0.001
Lower confidence limit	0.042	0.019	0.161	0.031	0.007	0.013	0.004
Upper confidence limit	0.043	0.022	0.184	0.032	0.016	0.015	0.008
Lower limit of tolerance	0.040	0.014	0.131	0.028	-	0.011	-
Upper limit of tolerance	0.046	0.027	0.214	0.034	0.031	0.017	0.013

Analyte (Unit)	**Co (%)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**Ba (%)**	**Cr (%)**	**Ni (%)**
Assigned value	0.001	0.001	0.005	0.009	0.000	0.011	0.004
Number of Laboratories	4	9	9	8	4	5	5
Number of Analyses	16	37	37	30	19	15	18
Between Laboratory Standard Deviation	0.001	0.001	0.002	0.003	0.000	0.001	0.002
Within Laboratory Standard Deviation	0.001	0.001	0.001	0.001	0.000	0.001	0.001
Between Laboratory Relative Standard Deviation	132 %	82 %	39 %	33 %	103 %	6.34 %	36 %
Within Laboratory Relative Standard Deviation	113 %	39 %	23 %	7.75 %	89 %	6.34 %	32 %
Standard Uncertainty	-	-	0.001	0.001	-	-	-
Lower confidence limit	-	0.001	0.004	0.007	-	0.010	0.004
Upper confidence limit	-	0.002	0.006	0.012	-	0.011	0.005
Lower limit of tolerance	-	-	0.001	0.003	-	0.009	0.001
Upper limit of tolerance	0.002	0.004	0.008	0.016	-	0.012	0.008

Analyte (Unit)	**Sn (%)**	**Sr (%)**	**V (%)**	**Zr (%)**
Assigned value	0.002	0.001	0.003	0.021
Number of Laboratories	3	3	5	3
Number of Analyses	12	12	18	12
Between Laboratory Standard Deviation	0.004	0.002	0.002	0.002
Within Laboratory Standard Deviation	0.001	0.001	0.001	0.001
Between Laboratory Relative Standard Deviation	203 %	195 %	49 %	11.6 %
Within Laboratory Relative Standard Deviation	63 %	109 %	24 %	5.43 %
Standard Uncertainty	0.002	0.001	0.001	0.001
Lower confidence limit	-	-	0.002	0.018
Upper confidence limit	0.007	0.003	0.005	0.023
Lower limit of tolerance	-	-	0.000	0.016
Upper limit of tolerance	0.010	0.004	0.007	0.025

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LOI Certified Values:

The LOI statistics from the inter-laboratory study are presented in the table below:

Table 5 ***Fe-108 LOI Certified Values (Hygroscopic Moisture Corrected)***

Determination (Unit)	LOI-371 %	LOI-425 %	LOI-650 %	LOI-1000 %
Assigned value	7.52	7.79	8.38	8.55
Number of Laboratories	4	10	10	15
Number of Analyses	30	54	54	77
Between Laboratory Standard Deviation	0.09	0.05	0.07	0.09
Within Laboratory Standard Deviation	0.05	0.04	0.05	0.07
Between Laboratory Relative Standard Deviation	1.23 %	0.69 %	0.77 %	0.99 %
Within Laboratory Relative Standard Deviation	0.67 %	0.49 %	0.56 %	0.79 %
Standard Uncertainty	0.040	0.013	0.016	0.016
Lower confidence limit	7.44	7.76	8.34	8.52
Upper confidence limit	7.60	7.81	8.41	8.58
Lower limit of tolerance	7.33	7.68	8.25	8.38
Upper limit of tolerance	7.70	7.90	8.51	8.72

Table 6 ***Fe-108 LOI Certified Values (non-hygroscopically corrected moisture)***

Determination (Unit)	LOI-371 %	LOI-425 %	LOI-650 %	LOI-1000 %
Assigned value	7.81	8.14	8.67	8.82
Number of Laboratories	10	6	11	19
Number of Analyses	56	37	60	92
Between Laboratory Standard Deviation	0.16	0.07	0.13	0.35
Within Laboratory Standard Deviation	0.05	0.07	0.06	0.08
Between Laboratory Relative Standard Deviation	2.01 %	0.79 %	1.48 %	3.92 %
Within Laboratory Relative Standard Deviation	0.65 %	0.79 %	0.71 %	0.89 %
Standard Uncertainty	0.053	0.012	0.039	0.080
Lower confidence limit	7.71	8.12	8.60	8.66
Upper confidence limit	7.92	8.17	8.75	8.98
Lower limit of tolerance	7.50	8.01	8.42	8.12
Upper limit of tolerance	8.13	8.27	8.93	9.51

Origin of Material:

This material originates from the iron ore deposits of the Hamersley Group of the Hamersley Iron Province, central Pilbara Craton in Western Australia. The Hamersley Group rocks are early Proterozoic sediments, i.e. shale, siltstone, mudstone, chert, carbonate rocks and banded iron formations. Some minor volcanic units are also present in the Hamersley Group stratigraphy. There are two banded iron ore deposits within the Hamersley Group, the Brockman Iron Formation (approximately 2481±4 Ma) and the older Marra Mamba Iron Formation (approximately 2597±5 Ma). The Brockman Formation consists of cherts, mudstone, siltstone and banded iron formations; and is the main iron ore zone within the Hamersley Group. The iron formation consists of significant amounts of secondary enriched martite-goethite, which has an iron content of between 56 and 63 wt.%. The Marra Mamba Iron Formation is a surface enriched banded iron formation consisting of martite microplaty hematite ores, containing 60 to 68 wt.% iron.

1. Killick, M. F., H. M. Churchward, R. R. Anand (2003) Hamersley Iron Province, Western Australia. CRC LEME, Exploration and Mining.
2. Morris, R. C., M. Kneeshaw, (2011): Genesis modelling for the Hamersley BIF-hosted iron ores of Western Australia: A critical review. Australian Journal of earth sciences 58.

Minor Elements and Specific Gravity:

Informational values for minor elements are provided; results from Lazer Ablation ICP-MS and for Specific Gravity by Helium Pycnometer (results are for a single analysis at one laboratory):

SG (Helium Pycnometer) 4.28

Table 7 ***Fe-108 Minor Elements***

As ppm	**Ba ppm**	**Be ppm**	**Bi ppm**	**Cd ppm**	**Ce ppm**	**Co ppm**	**Cs ppm**
130	32	6,2	0,24	-	46,9	10	0,72
Cu ppm	**Dy ppm**	**Er ppm**	**Eu ppm**	**Ga ppm**	**Gd ppm**	**Ge ppm**	**Hf ppm**
20	5,1	3,18	1,68	3,7	5,75	5,4	4,29
Ho ppm	**In ppm**	**La ppm**	**Lu ppm**	**Mn ppm**	**Mo ppm**	**Nb ppm**	**Nd ppm**
1,27	-	20,9	0,47	1390	3,6	4,31	24,5
Ni ppm	**Pb ppm**	**Pr ppm**	**Rb ppm**	**Re ppm**	**Sb ppm**	**Sc ppm**	**Se ppm**
46	44	6,21	3,2	-	1,2	3,8	-
Sm ppm	**Sn ppm**	**Sr ppm**	**Ta ppm**	**Tb ppm**	**Te ppm**	**Th ppm**	**Tl ppm**
5,23	1,4	4,8	0,95	0,99	-	3,32	-
Tm ppm	**U ppm**	**V ppm**	**W ppm**	**Y ppm**	**Yb ppm**	**Zn ppm**	**Zr ppm**
0,5	3,1	39,4	3,4	37	3,27	70	186

XRD Analysis:

A sample of Fe-108 was submitted for Quantiiative X-Ray Diffraction Analysis after drying at 50°C.
XRDQUANT01 - Quantitative analysis, crystalline and amorphous content

Table 8 ***Fe-108 Mineral Abundance (XRD)***

Mineral	% mass fraction
Hematite Fe_2O_3	23
Goethite FeO(OH)	54
Magnetite Fe_3O_4	ND
Quartz SiO_2	6
Amorphous content	18

Particle Size Distribution:

A sample of Fe-108 was submitted for particle size analysis by MICROTRAC S3500 Lazer Diffraction System.

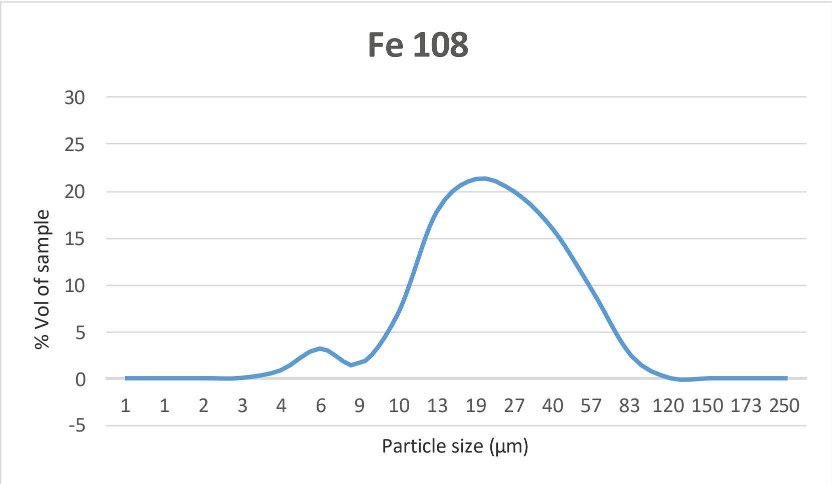

Figure 1 Fe-108 Particle Size Distribution

Spectral Analysis:

A sample of Fe-108 was submitted for analysis by TerraSpec 4 VNIR-SWIR.

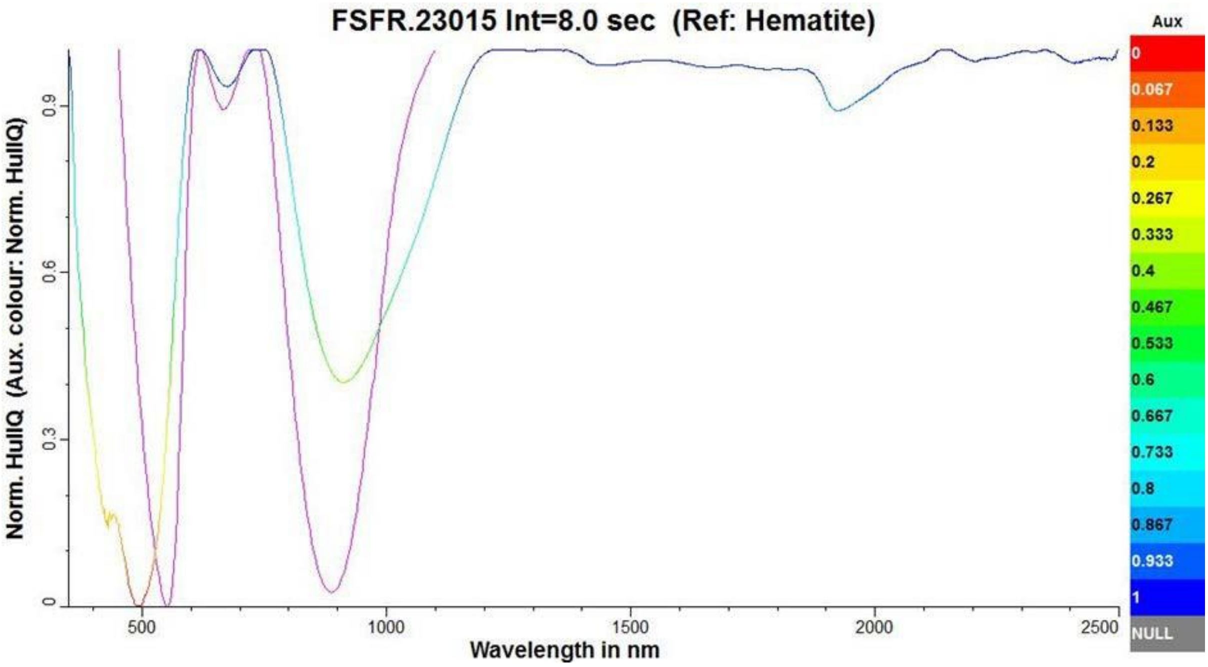

Figure 2 Fe-108 VNIR

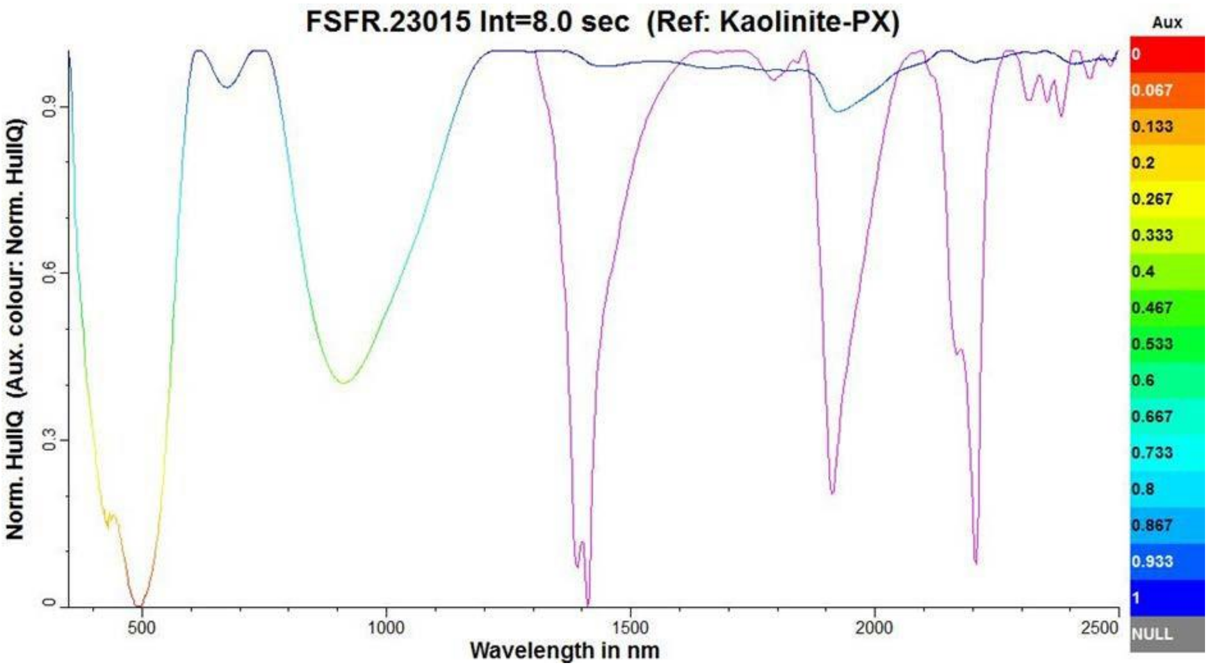

Figure 3 Fe-108 SWIR

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FTIR Analysis:

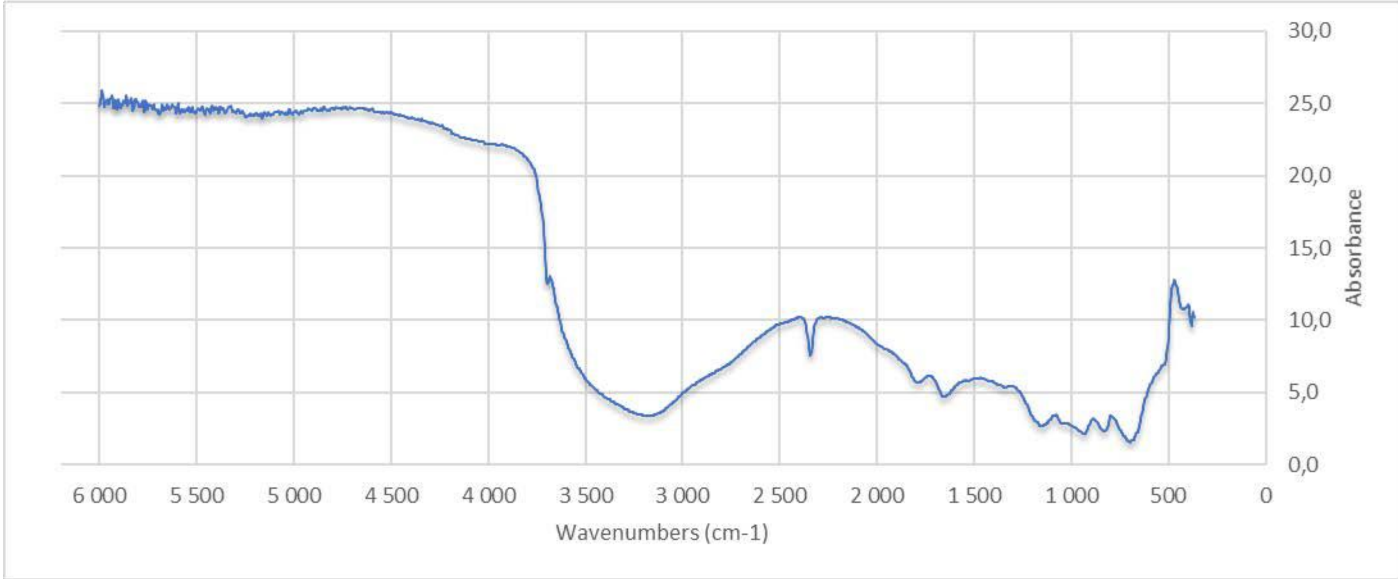

Figure 4 Fe-108 FTIR Spectra

Hygroscopic Moisture:

To illustrate the effect of hygroscopic moisture a sample of RRM Fe-108 underwent water vapour sorption testing.

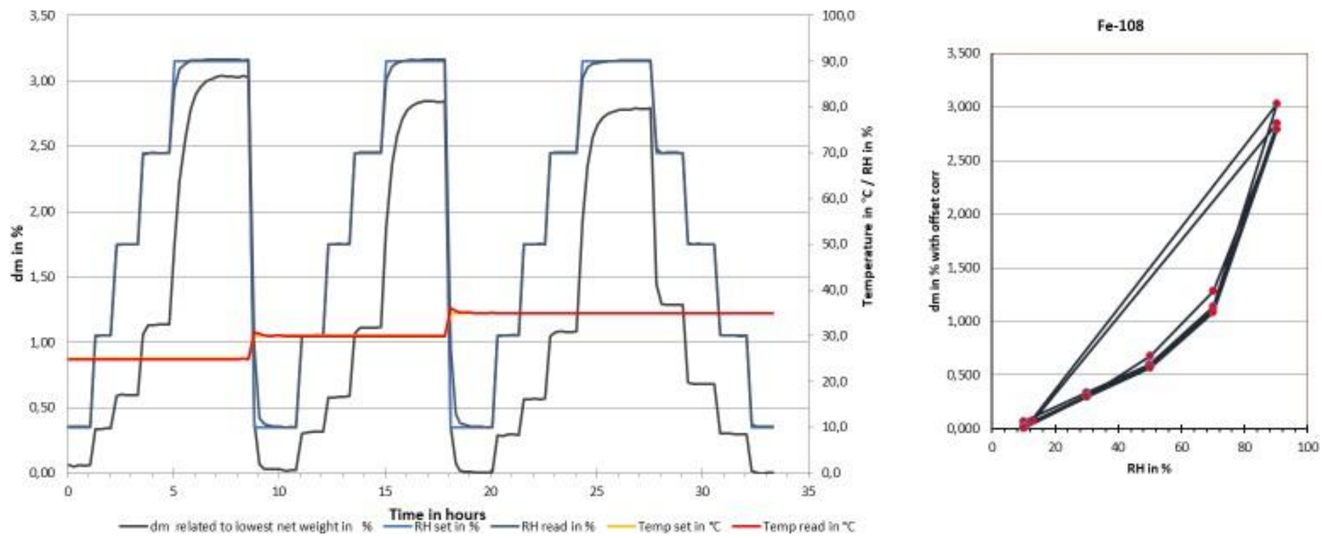

Figure 5 Fe-108 Sorption Testing

From the tests it is clear that hygroscopic moisture could have an impact on the quality of the chemical analysis results and appropriate storage and pre-treatment is highly recommended.

Participating Laboratories:

Table 9 ***Fe-108 Participating Laboratories***

ALS Metallurgy, Australia
ALS Iron Ore, Australia
BHP Billiton Nelson Point Laboratory, Australia
BHP Billiton Newman Laboratory Line 1, Australia
BHP Billiton Newman Laboratory Line 2, Australia
BHP Billiton Newman Laboratory Line 3, Australia
BHP Billiton Newman Laboratory Line 4, Australia
Bureau Veritas, South Australia
Bureau Veritas, Western Australia
Citic Pacific Mining Laboratory, Australia
IMP Automation, Australia
Intertek Maddington, Australia
Intertek Robotic Laboratories Anderson Point, Australia
Intertek Robotic Laboratories Christmas Creek, Australia
Intertek Robotic Laboratories Cloudbreak, Australia
Intertek Robotic Laboratories FMG Port, Australia
Intertek Robotic Laboratories Mt Webber, Australia
Intertek Robotic Laboratories Roy Hill Port, Australia
Intertek Robotic Laboratories Solomon, Australia
Kumba Iron Ore Sishen Mine Laboratory, South Africa
MinAnalytical Laboratory Services, Australia
Mitra SK Private Limited Bhubaneswar Labotratory, India
Mitra SK Private Limited Central Labotratory, India
Mitra SK Richards Bay Laboratory, South Africa
Mitra SK, Brazil
Rio Tinto Cape Lambert Port A Laboratory, Australia
Rio Tinto Cape Lambert Port B Laboratory, Australia
Rio Tinto Dampier Laboratory, Australia
Rio Tinto Marandoo Laboratory, Australia
Rio Tinto Paraburdoo Laboratory, Australia
Rio Tinto West Angelas Laboratory, Australia
Rio Tinto Yandicoogina Laboratory, Australia

(Reg. No. 2013/181983/07) Director: C van der Linde VAT: 4430266132

RESOURCE REFERENCE MATERIALS

Intended Use:

The Certified Reference Material RRM Fe-108 is intended to be used in analytical laboratories that analyse samples of similar grades (as presented in this certificate of analysis) and matrix.

- Monitoring of routine laboratory performance (both internal and external)
- Method development and method validation
- Instrument calibration

Instructions before Use:

Safety precautions (in-line with safe laboratory practices) for handling fine particulate matter are advised; such as the use of safety glasses, dust masks, gloves and laboratory coats.

Minimum Sample Size:

- Multi-element Iron Ore Suite – XRF fused disc analysis 0.7g
- LOI – 1g

Analysis Validity:

The property values for RRM Fe-108 Certified Reference Material remain valid provided that good laboratory practice is observed during handling and storage.

The material is in fine powder form and may be hygroscopic in nature.

Stability and storage:

This CRM is considered to have long-term stability under normal storage conditions. The CRM is available in different packaging and mass lots. When considering the lot size and said the ISO 16042, which recommends that the total contents of the container holding the CRM prior to its first use be divided in two portions that match the intended test portions.

Traceability:

The characterization of this material has been achieved by inter-laboratory study, each laboratory using an appropriate analytical method. These methods are calibrated against and analysed against high purity materials and appropriate Certified Reference Materials.

Additional Information:

Additional information on material RRM Fe-108 is available on request and includes the following:

- Data Tables
- Statistical Tables
- Particle Size Analysis Data
- Quantitative X-Ray Diffraction Analysis Report
- FTIR Spectral Data
- VNIR-SWIR Spectral Data
- Sorption Testing Data

Revisions:

This certificate is version 1.00 for the material RRM-Fe-108; and is intended to be a 'live document' intended to reflect progress in analytical chemistry. In that, any significant new data and information could be added at any time to ensure the currency and relevance of the certification.
This Certificate has been revised to correct discrepancies between Table 1 and Table 3, and Table 2 and Table 4.
Any further revisions to this Certificate of Analysis will be made available via the company website www.imstandards.com.au

Legal Notice:

This material has been prepared and a comprehensive statistical evaluation conducted to assign the property values, with appropriate care and attention. The Purchaser, by receipt of this material and certificate, indemnifies and releases Independent Mineral Standards (Pty) Ltd from and against any and all liability and costs arising from the use of this material and certificate and any actions taken thereupon.

Prepared and Supplied:

Certified Reference Material RRM Fe-108 has been prepared and certified and is supplied by; Resource Reference Materials (Pty) Ltd 36 Michelson Road Anderbolt, Boksburg South Africa, 1459
E-Mail: info@resourcereferencematerials.com

The Material is available from Independent Mineral Standards.
E-Mail: enquiries@imstandards.com.au

References:

ISO 17034:2016 General requirements for the competence of reference material producers
DRAFT ISO GUIDE 35:2016 Reference materials — Guidance for the characterization and the assessment of the homogeneity and stability of the material
ISO 5725-2:1994 Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method
ISO 2596:2006 Iron ores — Determination of hygroscopic moisture in analytical samples — Gravimetric, Karl Fischer and mass-loss methods
ISO 11536:2015 Iron ores — Determination of loss on ignition — Gravimetric method
ISO 9516-1:2003 Iron ores — Determination of various elements by X-ray fluorescence spectrometry — Part 1: Comprehensive procedure
ISO 2597: 2006 part 3 Iron ores — Determination of hygroscopic moisture in analytical samples — Gravimetric, Karl Fischer and mass-loss methods