Premium Certified Reference Material
RRM Fe-107

PRODUCT: IRON ORE
Pilbara Region Western Australian
CERTIFICATE OF ANALYSIS

Certificate Number: RRM CRM Fe-107 Rev 000 — Date: 3 June 2017

Table 1 ***Fe-107 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 (%)	49,43	0,17	0,23	49,29	49,65	8	15	1,9
Fe calculated (%)	48,80	0,13	0,22	48,66	48,94	8	15	1,9
SiO_2 (%)	22,32	0,15	0,25	22,16	22,48	8	15	1,9
Al_2O_3 (%)	2,06	0,02	0,02	2,05	2,08	8	15	1,9
TiO_2 (%)	0,102	0,001	0,002	0,100	0,103	8	15	1,9
Mn (%)	0,080	0,001	0,002	0,079	0,081	8	15	1,9
CaO (%)	0,053	0,001	0,002	0,052	0,054	8	15	1,9
MgO (%)	0,081	0,005	0,006	0,077	0,084	8	15	1,9
K_2O (%)	0,027	0,001	0,001	0,027	0,028	8	15	1,9
Na_2O (%)	0,015	0,004	0,01	0,008	0,022	7	14	2,0
P (%)	0,057	-	0,001	0,056	0,057	8	15	1,9
S (%)	0,046	-	0,003	0,044	0,048	7	11	1,6
LOI-371 %	4,45	0,03	0,05	4,93	4,50	3	27	9,0
LOI-425 %	4,64	0,03	0,04	4,61	4,66	8	39	4,9
LOI-650 %	5,05	0,06	0,07	5,02	5,08	8	39	4,9
LOI-1000 %	4,99	0,07	0,10	4,94	5,04	11	42	3,8
Cl (%)	0,003	-	0,002	0,001	0,005	6	13	2,2
As (%)	0,002	0,001	0,001	0,001	0,003	7	14	2,0
Ba (%)	0,001	-	0,001	-	0,002	7	14	2,0
Co (%)	0,004	-	0,002	0,002	0,005	7	14	2,0
Cu (%)	0,013	0,001	0,002	0,012	0,015	7	14	2,0
Cr (%)	0,017	-	-	-	-	3	4	1,3
Ni (%)	-	-	-	-	-	6	10	1,7
Pb (%)	0,031	0,001	0,002	0,029	0,032	7	14	2,0
Sn (%)	0,002	-	0,002	-	0,004	7	14	2,0
Sr (%)	-	-	-	-	-	6	10	1,7
V (%)	0,001	-	0,001	-	0,002	6	10	1,7
Zn (%)	0,001	-	0,001	0,001	0,002	6	13	2,2
Zr (%)	0,051	0,001	0,005	0,047	0,055	6	13	2,2

Table 2 *Fe-107 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 (%)	49,21	0,18	0,32	49,08	49,34	19	69	3,6
Fe calculated (%)	48,84	0,11	0,22	48,74	48,93	19	69	3,6
SiO_2 (%)	22,11	0,15	0,28	22,00	22,22	19	69	3,6
Al_2O_3 (%)	2,03	0,02	0,04	2,02	2,05	19	69	3,6
TiO_2 (%)	0,104	0,002	0,003	0,103	0,105	19	69	3,6
Mn (%)	0,081	0,001	0,002	0,080	0,082	16	61	3,8
CaO (%)	0,049	0,002	0,006	0,046	0,052	19	69	3,6
MgO (%)	0,077	0,006	0,018	0,068	0,086	19	69	3,6
K_2O (%)	0,026	0,001	0,003	0,025	0,028	19	69	3,6
Na_2O (%)	0,016	0,005	0,012	0,010	0,022	14	50	3,6
P (%)	0,057	0,001	0,001	0,057	0,058	19	69	3,6
S (%)	0,043	0,001	0,004	0,041	0,045	18	65	3,6
LOI-371 %	4,63	0,03	0,08	4,59	4,67	11	55	5,0
LOI-425 %	4,80	0,04	0,10	4,74	4,87	9	41	4,6
LOI-650 %	5,22	0,03	0,09	5,17	5,27	14	62	4,4
LOI-1000 %	5,25	0,07	0,14	5,19	5,30	22	96	4,4
Cl (%)	0,002	0,001	0,001	0,001	0,003	10	34	3,4
As (%)	0,004	0,001	0,004	0,002	0,007	9	34	3,8
Ba (%)	0,001	-	0,001	-	0,001	8	24	3,0
Co (%)	0,003	0,001	0,002	0,002	0,005	12	43	3,6
Cu (%)	0,013	0,001	0,002	0,012	0,013	12	40	3,3
Cr (%)	0,016	0,001	0,001	0,015	0,016	9	30	3,3
Ni (%)	0,003	0,002	0,003	0,001	0,006	5	13	2,6
Pb (%)	0,032	0,001	0,002	0,030	0,033	7	21	3,0
Sn (%)	0,003	-	0,002	0,002	0,004	7	21	3,0
Sr (%)	0,001	0,001	0,001	-	0,002	4	11	2,8
V (%)	0,001	-	0,001	-	0,001	4	11	2,8
Zn (%)	0,002	0,001	0,001	0,001	0,003	6	15	2,5
Zr (%)	0,051	0,003	0,004	0,048	0,053	6	17	2,8

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.

Preparation of Material:

The material constituting RRM Fe-107 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-107 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.

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Table 3 ***Fe-107 Statistical Evaluation (Hygroscopic Moisture Corrected)***

Analyte (Unit)	**Fe (%)**	**Fe calc (%)**	**SiO_2 (%)**	**Al_2O_3 (%)**	**TiO_2 (%)**	**Mn (%)**	**CaO (%)**
Assigned value	49.43	48.80	22.32	2.06	0.102	0.080	0.053
Number of Laboratories	8	8	8	8	8	8	8
Number of Analyses	15	15	15	15	15	15	15
Between Laboratory Standard Deviation	0.23	0.22	0.25	0.024	0.002	0.002	0.002
Within Laboratory Standard Deviation	0.17	0.13	0.15	0.015	0.001	0.001	0.001
Between Laboratory Relative Standard Deviation	0.46 %	0.44 %	1.12 %	1.18 %	2.42 %	2.03 %	3.08 %
Within Laboratory Relative Standard Deviation	0.35 %	0.26 %	0.68 %	0.74 %	1.45 %	0.98 %	1.28 %
Standard Uncertainty	0.068	0.070	0.079	0.008	0.001	0.001	0.001
Lower confidence limit	49.29	48.66	22.16	2.05	0.100	0.079	0.052
Upper confidence limit	49.56	48.94	22.48	2.08	0.103	0.081	0.054
Lower limit of tolerance	48.97	48.36	21.82	2.01	0.097	0.077	0.050
Upper limit of tolerance	49.88	49.23	22.82	2.11	0.107	0.083	0.056

Analyte (Unit)	**P (%)**	**S (%)**	**MgO (%)**	**K_2O (%)**	**Na_2O (%)**	**As (%)**	**Cl (%)**
Assigned value	0.057	0.046	0.081	0.027	0.015	0.003	0.002
Number of Laboratories	8	7	8	8	7	6	7
Number of Analyses	15	11	15	15	14	13	14
Between Laboratory Standard Deviation	0.001	0.003	0.006	0.001	0.010	0.002	0.001
Within Laboratory Standard Deviation	-	-	0.005	0.001	0.004	-	0.001
Between Laboratory Relative Standard Deviation	1.22 %	6.62 %	7.45 %	4.11 %	64 %	67 %	83 %
Within Laboratory Relative Standard Deviation	-	0.64 %	5.71 %	3.14 %	27 %	-	49 %
Standard Uncertainty	-	0.001	0.002	-	0.003	0.001	0.001
Lower confidence limit	0.056	0.044	0.077	0.027	0.008	0.001	0.001
Upper confidence limit	0.057	0.048	0.084	0.028	0.022	0.005	0.003
Lower limit of tolerance	0.055	0.040	0.069	0.025	-	-	-
Upper limit of tolerance	0.058	0.052	0.093	0.029	0.034	0.007	0.004

Analyte (Unit)	**Co (%)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**Ba (%)**	**Cr (%)**	**Ni (%)**
Assigned value	0.001	0.004	0.013	0.014	-	0.031	0.002
Number of Laboratories	7	7	7	3	6	7	7
Number of Analyses	14	14	14	4	10	14	14
Between Laboratory Standard Deviation	0.001	0.002	0.002	-	-	0.002	0.002
Within Laboratory Standard Deviation	-	-	0.001	-	-	0.001	-
Between Laboratory Relative Standard Deviation	118 %	61 %	14.1 %	-	-	7.29 %	112 %
Within Laboratory Relative Standard Deviation	9.81 %	10.9 %	6.32 %	-	-	2.68 %	-
Standard Uncertainty	0.001	0.001	0.001	-	-	0.001	0.001
Lower confidence limit	-	0.002	0.012	-	-	0.029	-

Upper confidence limit	0.002	0.005	0.015	-	-	0.032	0.004
Lower limit of tolerance	-	-	0.010	0.014	-	0.026	-
Upper limit of tolerance	0.004	0.008	0.017	0.014	-	0.035	0.006

Analyte (Unit)	**Sn (%)**	**Sr (%)**	**V (%)**	**Zr (%)**
Assigned value	-	0.001	0.001	0.051
Number of Laboratories	6	6	6	6
Number of Analyses	10	10	13	13
Between Laboratory Standard Deviation	-	0.001	0.001	0.005
Within Laboratory Standard Deviation	-	-	-	0.001
Between Laboratory Relative Standard Deviation	-	111 %	44 %	9.48 %
Within Laboratory Relative Standard Deviation	-	18.7 %	22 %	1.99 %
Standard Uncertainty	-	0.001	-	0.002
Lower confidence limit	-	-	0.001	0.047
Upper confidence limit	-	0.002	0.002	0.055
Lower limit of tolerance	-	-	-	0.041
Upper limit of tolerance	-	0.004	0.003	0.060

Table 4 ***Fe-107 Statistical Evaluation (non-hygroscopically moisture corrected)***

Analyte (Unit)	**Fe (%)**	**Fe calc (%)**	**SiO_2 (%)**	**Al_2O_3 (%)**	**TiO_2 (%)**	**Mn (%)**	**CaO (%)**
Assigned value	49.21	48.84	22.11	2.03	0.104	0.081	0.049
Number of Laboratories	19	19	19	19	19	16	19
Number of Analyses	69	69	69	69	69	61	69
Between Laboratory Standard Deviation	0.32	0.22	0.28	0.04	0.003	0.002	0.006
Within Laboratory Standard Deviation	0.18	0.11	0.15	0.02	0.002	0.001	0.002
Between Laboratory Relative Standard Deviation	0.65 %	0.45 %	1.25 %	1.92 %	2.93 %	2.82 %	12.4 %
Within Laboratory Relative Standard Deviation	0.36 %	0.23 %	0.67 %	0.89 %	2.11 %	0.94 %	4.91 %
Standard Uncertainty	0.065	0.046	0.056	0.008	0.001	0.001	0.001
Lower confidence limit	49.08	48.74	22.00	2.02	0.103	0.080	0.046
Upper confidence limit	49.34	48.93	22.22	2.05	0.105	0.082	0.052
Lower limit of tolerance	48.57	48.39	21.56	1.96	0.098	0.076	0.037
Upper limit of tolerance	49.85	49.28	22.66	2.11	0.110	0.085	0.061

Analyte (Unit)	**P (%)**	**S (%)**	**MgO (%)**	**K_2O (%)**	**Na_2O (%)**	**As (%)**	**Cl (%)**
Assigned value	0.057	0.043	0.077	0.026	0.016	0.002	0.004
Number of Laboratories	19	18	19	19	14	10	9
Number of Analyses	69	65	69	69	50	34	34
Between Laboratory Standard Deviation	0.001	0.004	0.018	0.003	0.012	0.001	0.004

Within Laboratory Standard Deviation	0.001	0.001	0.006	0.001	0.005	-	0.001
Between Laboratory Relative Standard Deviation	1.79 %	9.49 %	24 %	12.1 %	74 %	60 %	92 %
Within Laboratory Relative Standard Deviation	1.44 %	2.35 %	7.81 %	4.10 %	31 %	9.96 %	18.2 %
Standard Uncertainty	-	0.001	0.004	0.001	0.003	-	0.001
Lower confidence limit	0.057	0.041	0.068	0.025	0.010	0.001	0.002
Upper confidence limit	0.058	0.045	0.086	0.028	0.022	0.003	0.007
Lower limit of tolerance	0.055	0.035	0.040	0.020	-	-	-
Upper limit of tolerance	0.059	0.052	0.114	0.033	0.039	0.005	0.011

Analyte (Unit)	**Co (%)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**Ba (%)**	**Cr (%)**	**Ni (%)**
Assigned value	0.001	0.003	0.013	0.016	0.003	0.032	0.003
Number of Laboratories	8	12	12	9	5	7	7
Number of Analyses	24	43	40	30	13	21	21
Between Laboratory Standard Deviation	0.001	0.002	0.002	0.001	0.003	0.002	0.002
Within Laboratory Standard Deviation	-	0.001	0.001	0.001	0.002	0.001	-
Between Laboratory Relative Standard Deviation	92 %	73 %	12.2 %	6.41 %	101 %	4.92 %	66 %
Within Laboratory Relative Standard Deviation	35 %	33 %	6.71 %	4.69 %	74 %	3.13 %	16.0 %
Standard Uncertainty	-	0.001	-	-	0.001	0.001	0.001
Lower confidence limit	-	0.002	0.012	0.015	0.001	0.030	0.002
Upper confidence limit	0.001	0.005	0.013	0.016	0.006	0.033	0.004
Lower limit of tolerance	-	-	0.009	0.014	-	0.028	-
Upper limit of tolerance	0.002	0.008	0.016	0.018	0.010	0.035	0.007

Analyte (Unit)	**Sn (%)**	**Sr (%)**	**V (%)**	**Zr (%)**
Assigned value	0.001	0.001	0.002	0.051
Number of Laboratories	4	4	6	6
Number of Analyses	11	11	15	17
Between Laboratory Standard Deviation	0.001	0.001	0.001	0.004
Within Laboratory Standard Deviation	0.001	-	0.001	0.003
Between Laboratory Relative Standard Deviation	195 %	99 %	44 %	7.21 %
Within Laboratory Relative Standard Deviation	75 %	67 %	28 %	5.73 %
Standard Uncertainty	0.001	-	-	0.001
Lower confidence limit	-	-	0.001	0.048
Upper confidence limit	0.002	0.001	0.003	0.053
Lower limit of tolerance	-	-	0.000	0.043
Upper limit of tolerance	0.003	0.002	0.004	0.058

LOI Certified Values:

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

Table 5 ***Fe-107 LOI Certified Values (Hygroscopic Moisture Corrected)***

Determination (Unit)	LOI-371 %	LOI-425 %	LOI-650 %	LOI-1000 %
Assigned value	4.45	4.64	5.05	4.99
Number of Laboratories	3	8	8	11
Number of Analyses	27	39	39	42
Between Laboratory Standard Deviation	0.05	0.04	0.07	0.10
Within Laboratory Standard Deviation	0.03	0.03	0.06	0.07
Between Laboratory Relative Standard Deviation	1.21 %	0.89 %	1.31 %	2.04 %
Within Laboratory Relative Standard Deviation	0.65 %	0.54 %	1.11 %	1.38 %
Standard Uncertainty	0.027	0.012	0.015	0.025
Lower confidence limit	4.39	4.61	5.02	4.94
Upper confidence limit	4.50	4.66	5.08	5.04
Lower limit of tolerance	4.34	4.55	4.92	4.78
Upper limit of tolerance	4.55	4.72	5.19	5.19

Table 6 ***Fe-107 LOI Certified Values (non-hygroscopically corrected moisture)***

Determination (Unit)	LOI-371 %	LOI-425 %	LOI-650 %	LOI-1000 %
Assigned value	4.63	4.80	5.22	5.25
Number of Laboratories	11	9	14	22
Number of Analyses	55	41	62	96
Between Laboratory Standard Deviation	0.08	0.10	0.09	0.14
Within Laboratory Standard Deviation	0.03	0.04	0.03	0.07
Between Laboratory Relative Standard Deviation	1.62 %	2.12 %	1.72 %	2.69 %
Within Laboratory Relative Standard Deviation	0.73 %	0.82 %	0.61 %	1.34 %
Standard Uncertainty	0.021	0.032	0.024	0.028
Lower confidence limit	4.59	4.74	5.17	5.19
Upper confidence limit	4.67	4.87	5.27	5.30
Lower limit of tolerance	4.48	4.60	5.04	4.97
Upper limit of tolerance	4.78	5.00	5.40	5.53

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) 4.09

Table 7 *Fe-107 Minor Elements*

As ppm	Ba ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm	Co ppm	Cs ppm
30,4	34	0,8	0,68	-	15,7	9,5	0,27
Cu ppm	**Dy ppm**	**Er ppm**	**Eu ppm**	**Ga ppm**	**Gd ppm**	**Ge ppm**	**Hf ppm**
48	1,46	1,24	0,39	2	1,24	6,95	11,4
Ho ppm	**In ppm**	**La ppm**	**Lu ppm**	**Mn ppm**	**Mo ppm**	**Nb ppm**	**Nd ppm**
0,33	-	7,91	0,23	870	1,6	2,93	7,12
Ni ppm	**Pb ppm**	**Pr ppm**	**Rb ppm**	**Re ppm**	**Sb ppm**	**Sc ppm**	**Se ppm**
40	117	1,87	1,8	-	1,6	3,6	-
Sm ppm	**Sn ppm**	**Sr ppm**	**Ta ppm**	**Tb ppm**	**Te ppm**	**Th ppm**	**Tl ppm**
1,44	1,6	3,9	2,39	0,21	-	2,53	-
Tm ppm	**U ppm**	**V ppm**	**W ppm**	**Y ppm**	**Yb ppm**	**Zn ppm**	**Zr ppm**
0,2	11,4	23,9	6,95	10,7	1	135	474

XRD Analysis:

A sample of Fe-107 was submitted for Quantiiative X-Ray Diffraction Analysis after drying at 50°C.
XRDQUANT01 - Quantitative analysis, crystalline and amorphous content

Table 8 *Fe-107 Mineral Abundance (XRD)*

Mineral	% mass fraction
Hematite Fe_2O_3	32
Goethite FeO(OH)	31
Magnetite Fe_3O_4	ND
Quartz SiO_2	18
Kaolin $Al_2Si_2O_5(OH)_4$	ND
Pyrolusite MnO_2	1
Amorphous content	19

Particle Size Distribution:

A sample of Fe-107 was submitted for particle size analysis by MICROTRAC S3500 Lazer Diffraction System.

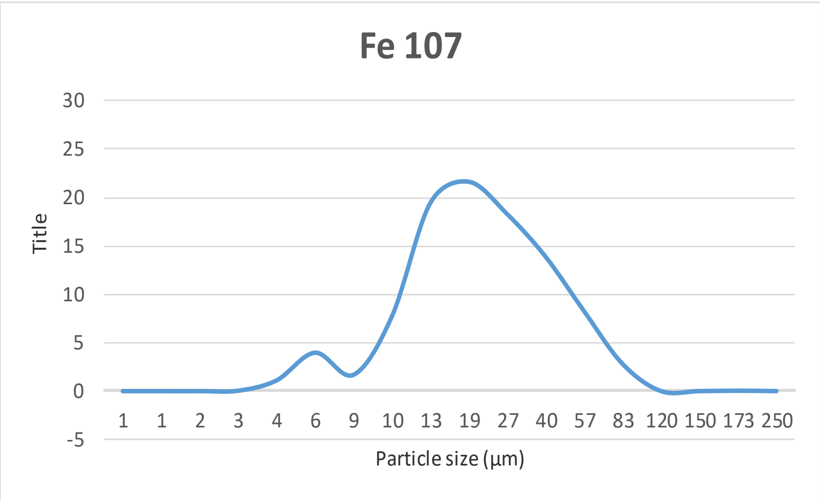

Figure 1 Fe-107 Particle Size Distribution

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Spectral Analysis:

A sample of Fe-107 was submitted for analysis by TerraSpec 4 VNIR-SWIR.

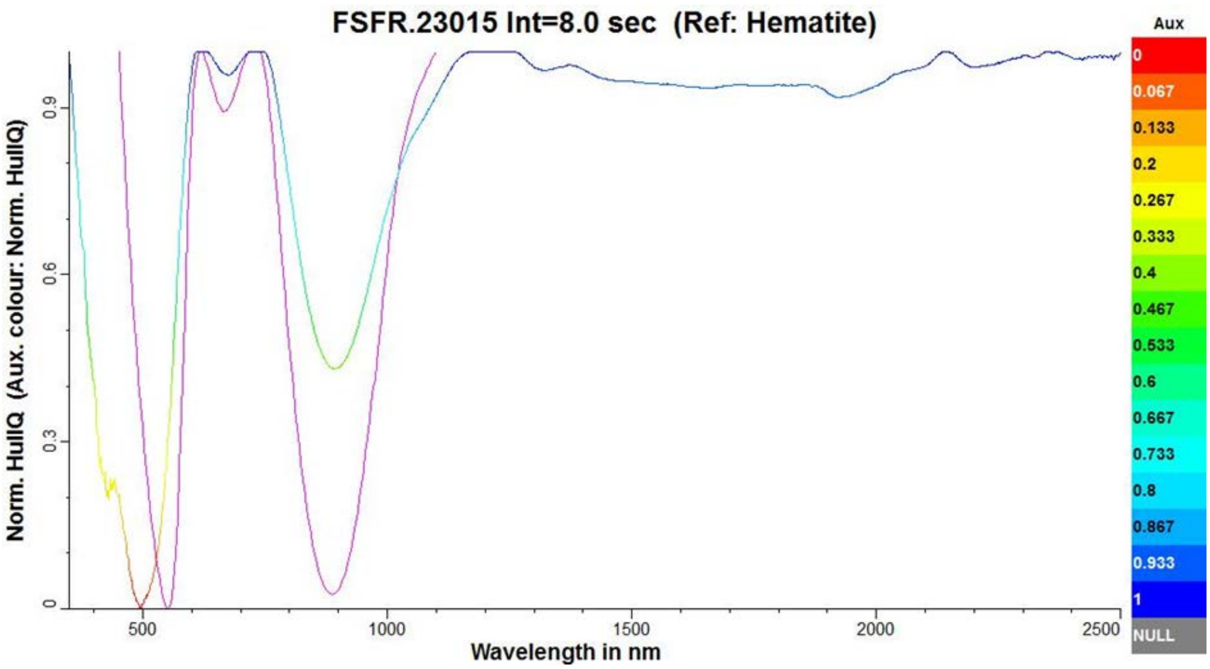

Figure 2 Fe-107 VNIR

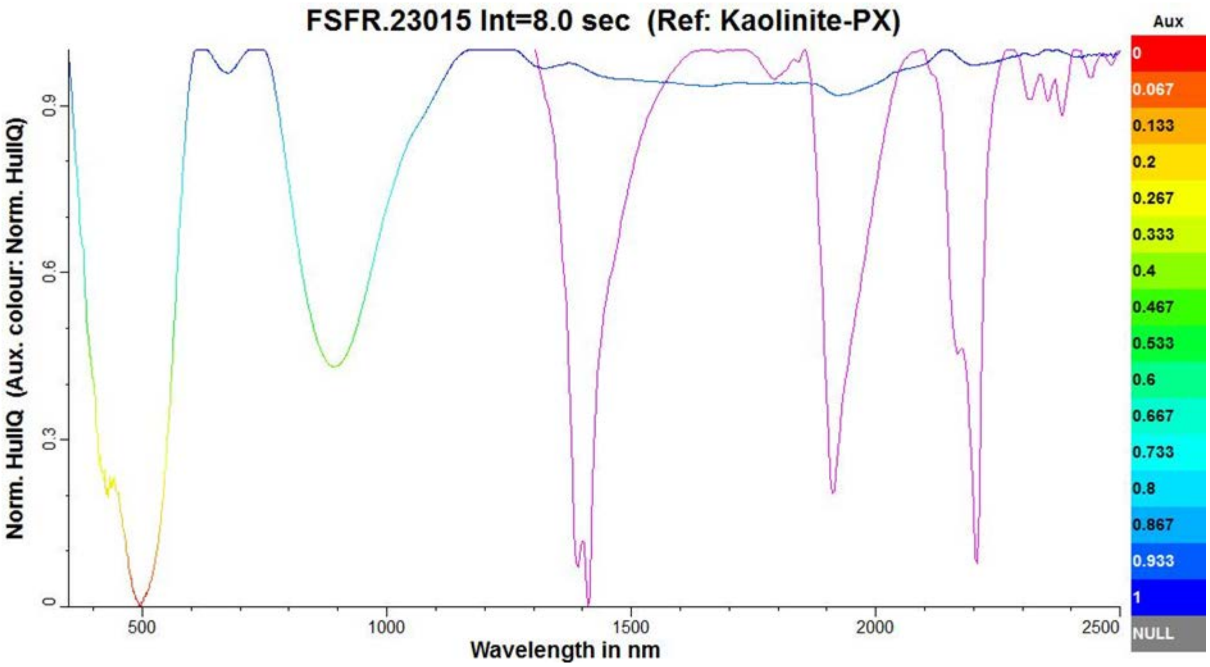

Figure 3 Fe-107 SWIR

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FTIR Analysis:

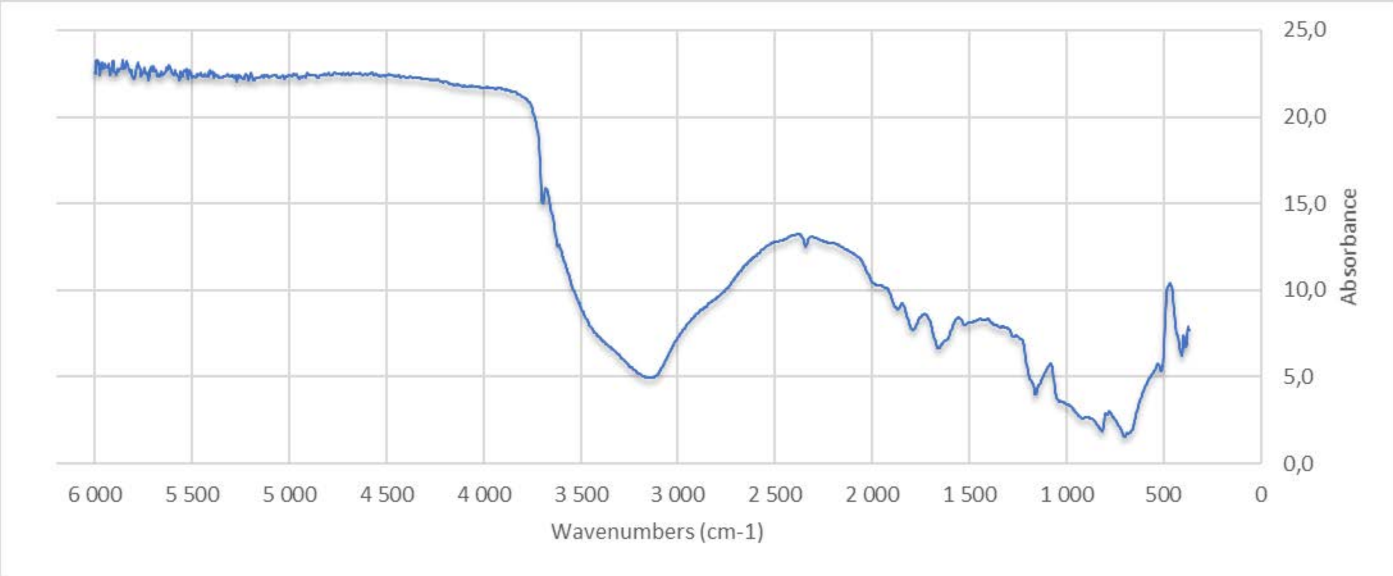

Figure 4 Fe-107 FTIR Spectra

Hygroscopic Moisture:

To illustrate the effect of hygroscopic moisture a sample of RRM Fe-107 underwent water vapour sorption testing.

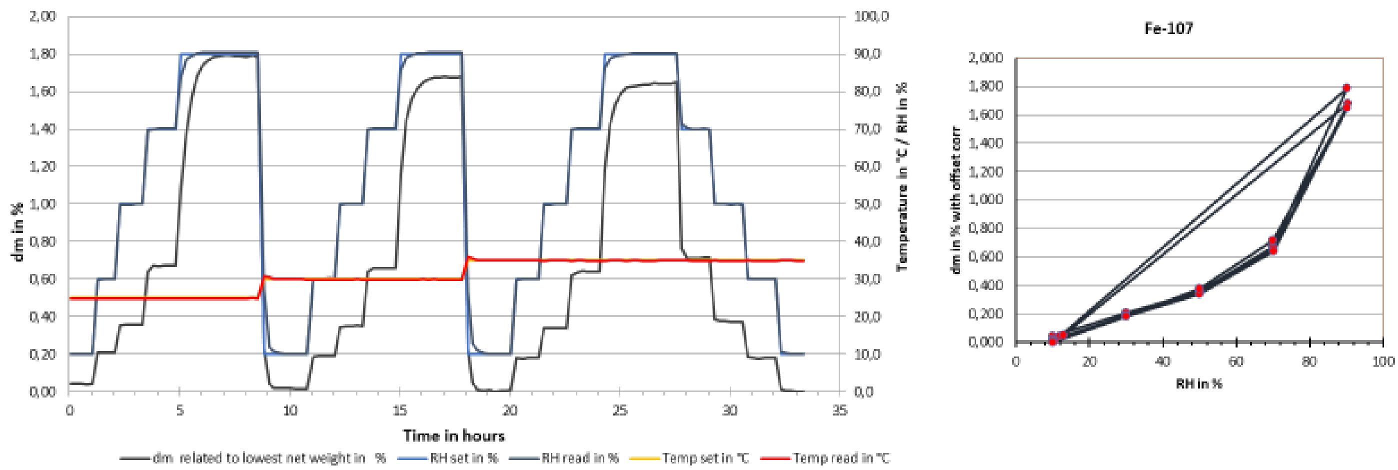

Figure 5 Fe-107 Sorption Testing

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-107 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
Intertek, South Africa
Kumba Iron Ore Sishen Mine Laboratory, South Africa
MinAnalytical Laboratory Services, Australia
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
Set Point Laboratories, South Africa

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RRM
RESOURCE REFERENCE MATERIALS

Intended Use:

The Certified Reference Material RRM Fe-107 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-107 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-107 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

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Revisions:

This certificate is version 0.00 for the material RRM-Fe-107; 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. Any revisions to this Certificate of Analysis will be made available via the company website www.resourcereferencematerials.com

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 Resource Reference Materials (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-107 has been prepared, certified and is supplied by;

Resource Reference Materials (Pty) Ltd
36 Michelson Road
Anderbolt, Boksburg
South Africa, 1459
E-Mail: info@resourcereferencematerials.com

Approved on behalf of Resource Reference Materials (Pty) Ltd:

3rd June 2017

Name	*C.S. van der Linde*
Position	*Managing Director*

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