ECISS

EUROPEAN COMMITTEE FOR IRON AND STEEL STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION DU FER ET DE L'ACIER
EUROPÄISCHES KOMITEE FÜR EISEN-UND STAHLNORMUNG

EUROPEAN CERTIFIED REFERENCE MATERIAL (EURONORM – CRM)
CERTIFICATE OF CHEMICAL ANALYSIS

EURONORM – CRM No. **688-1** Iron ore

LABORATORY MEANS (4 values) - Mass content in %

Line No	Fe	Si	Ca	Mg	Al	Ti	Mn	P	Ni	Na	K	Co	Cu	V
1	61.130	------	1.3808	1.0225	0.6384	0.3850	0.0425	0.3189	0.0115	0.2948	0.1673	0.0090	0.0016	0.1270
2	61.268	------	1.3818	1.0349	0.6409	0.3914	0.0429	0.3251	0.0117	0.3027	0.1706	0.0090	0.0018	0.1302
3	61.294	3.3390	1.4198	1.0421	0.6628	0.3978	0.0430	0.3255	0.0120	0.3136	0.1735	0.0090	0.0019	-----
4	61.310	3.3593	1.4218	1.0450	0.6660	0.4048	0.0448	0.3308	0.0124	0.3141	0.1740	0.0091	0.0020	0.1323
5	61.319	3.3603	1.4285	1.0454	0.6724	0.4076	0.0453	0.3309	0.0129	0.3195	0.1748	0.0091	0.0021	0.1328
6	61.321	3.3688	1.4407	1.0493	0.6782	0.4085	0.0457	0.3322	0.0131	0.3204	0.1754	0.0093	0.0022	0.1339
7	61.343	3.3689	1.4420	1.0550	0.6796	0.4087	0.0458	0.3323	0.0134	0.3249	0.1755	0.0093	0.0022	0.1345
8	61.345	3.3710	1.4438	1.0596	0.6819	0.4089	0.0458	0.3340	0.0135	0.3269	0.1772	0.0094	0.0022	0.1348
9	61.345	3.3824	1.4545	1.0598	0.6870	0.4101	0.0460	0.3361	0.0137	0.3416	0.1818	0.0096	0.0023	0.1348
10	61.412	3.3862	1.4587	1.0613	0.6902	0.4120	0.0460	0.3388	0.0138	0.3421	0.1831	0.0097	0.0024	0.1372
11	61.450	3.3882	1.4675	1.0630	0.6915	0.4143	0.0460	0.3426	0.0140	0.3447	0.1844	0.0097	0.0024	0.1375
12	61.506	3.3960	1.4712	1.0803	0.7010	0.4155	0.0468	0.3440	0.0140	0.3450	0.1855	0.0099	0.0024	0.1382
13	61.512	3.4041	1.4713	1.0810	0.7025	0.4173	0.0469	0.3498	0.0141	0.3501	0.1856	0.0100	0.0025	0.1389
14	61.549	3.4075	1.4749	1.0865	0.7141	0.4247	0.0469	0.3510	0.0142	0.3513	0.1863	0.0100	0.0025	0.1394
15	61.650	3.4076	1.4771	1.0931			0.0474	0.3514	0.0146	0.3528	0.1884	0.0101	0.0026	0.1411
16	-----	3.4232	1.4821	-----			0.0477	0.3565	0.0154	0.3579	0.1953	0.0102	0.0026	
17			1.5193	1.0997			0.0479		0.0169	0.3609		-----	0.0027	
18												0.0105	0.0027	
M_M	**61.384**	**3.3830**	**1.4492**	**1.0612**	**0.6790**	**0.4076**	**0.0457**	**0.3375**	**0.0136**	**0.3331**	**0.1799**	**0.0096**	**0.0023**	**0.1352**
s_M	0.131	0.0233	0.0357	0.0219	0.0219	0.0104	0.0017	0.0109	0.0014	0.0201	0.0075	0.0005	0.0004	0.0039
s_W	0.054	0.0178	0.0135	0.0086	0.0107	0.0052	0.0010	0.0045	0.0004	0.0059	0.0042	0.0002	0.0002	0.0018

Line No	Pb	Zn
1	0.00019	0.0010
2	0.00020	0.0010
3	0.00021	0.0011
4	0.00023	0.0012
5	0.00023	0.0013
6	0.00025	0.0013
7	0.00025	0.0013
8	0.00030	0.0014
9	0.00033	0.0015
10	0.00033	0.0016
11		0.0017
12		0.0017
13		0.0019
14		0.0020
15		0.0020
16		-----
17		-----
M_M	**0.00025**	**0.0015**
s_M	0.00005	0.0004
s_W	0.00006	0.0001

S	*Cr*	*Sn*
0.0432	*0.0015*	*0.00022*
0.0442	*0.0017*	*0.00023*
0.0450	*0.0017*	*0.00024*
0.0451	*0.0018*	*0.00030*
0.0452	*0.0019*	*0.00046*
0.0470	*0.0022*	*0.00050*
0.0477	*0.0024*	-----
0.0484	*0.0025*	
0.0493	*0.0025*	
0.0494	*0.0035*	
0.0503		

M_M: Mean of the intralaboratory means
s_M: Standard deviation of the intralaboratory means
s_w: Intralaboratory standard deviation

The laboratory mean values have been examined statistically to eliminate outlying values.
Where a "------" appears in the table it indicates that an outlying value has been eliminated by either the Cochran or Grubbs Test.

Values given in italics are for information only.

Additional values from laboratories, for information (in µg/g):
As: 11, B: 5, Be: 1, Ce: 55, Ga: 36, Gd: 3.5, Hf: 0.4, Hg: 0.5, Ho: 0.7, La: 26, Lu: 0.3, Nb: 1.6, Nd: 26, Pr: 7, Rb : 9, Sb: 0.1, Sc: 7, Se: 0.7, Sm: 4.6, Sr : 19, Ta : 0.1, Tb : 0.6, Th : 14, Tm : 0.3, U : 2, Y : 19, Yb : 2, Zr : 15

CERTIFIED VALUES - Mass content in %

	Fe	Si	Ca	Mg	Al	Ti	Mn	P
M_M	**61.38**	**3.383**	**1.449**	**1.061**	**0.679**	**0.408**	**0.0457**	**0.337**
C (95 %)	**0.08**	**0.014**	**0.019**	**0.012**	**0.013**	**0.006**	**0.0009**	**0.006**

	Ni	Na	K	Co	Cu	V	Pb	Zn
M_M	**0.0136**	**0.333**	**0.180**	**0.0096**	**0.0023**	**0.135**	**0.00025**	**0.0015**
C (95 %)	**0.0007**	**0.011**	**0.004**	**0.0003**	**0.0002**	**0.003**	**0.00004**	**0.0002**

The half-width confidence interval C(95%) = $\frac{t \times s_M}{\sqrt{n}}$ where "t" is the appropriate Student's t value and "n" is the number of acceptable mean values

For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 sections 6.1 and 10.5.2

This reference material was prepared in accordance with the recommendations set out in ISO Guides 30 – 35 and issued by:

swerea | KIMAB

Drottning Kristinas väg 48, SE 114 28, Stockholm, Sweden

On behalf of: The Iron and Steel Nomenclature Co-ordinating Committee (COCOR) of the ECISS, after approval by all the participating laboratories and all the producing organisations.
(France-IRSID/CTIF; Germany-Iron and Steel CRM Working Group: Stahlinstitut VDEh, BAM Bundesanstalt für Materialforschung und -prüfung & MPI für Eisenforschung; UK-BAS Ltd; Nordic Countries-Nordic CRM Working Group)

SEPTEMBER 2010

EURONORM – CRM No. 688-1

METHODS USED

Element	Line number	Analytical methods
Fe	1.4	Titration with Mn (VII) after reduction with Sn (II)
	2.3.5.8.11.12.14	Titration with Cr (VI) after reduction with Sn (II)
	6	XRF
	7.9.10.13.15	Titration with Cr (VI) after reduction with Ti (III)
Si	3.4.6.7.9.13.16	Gravimetry, dehydration with perchloric acid
	5	XRF
	8.11.12	ICP-OES
	10	Spectrophotometry, silicomolybdate, without extraction
	14	FAAS
	15	Gravimetry, dehydration with sulphuric acid
Ca	1.2.3.4.5.7.11.12.13.14.16.17	ICP-OES
	6	ICP-MS
	8.15	FAAS
	9	Complexometric titration, visual end point
	10	XRF
Mg	1.2.3.4.6.7.8.9.10.13.15.17	ICP-OES
	5.11	FAAS
	12	XRF
	14	ICP-MS
Al	1.4.5.6.7.8.9.12.14	ICP-OES
	2	ICP-MS
	3, 13	FAAS
	10	XRF
	11	Spectrophotometry, hydroxyquinolate, with extraction
Ti	1.3.4.5.6.7.8.10.12.13	ICP-OES
	2	Spectrophotometry, diantipyrylmethane
	9	XRF
	11	FAAS
	14	Spectrophotometry, chromotropic acid, without separation
Mn	1.17	Spectrophotometry, periodate oxidation
	2.3.5.6.7.9.10.12.13.14.16	ICP-OES
	4	XRF
	8.15	FAAS
	11	ICP-MS
P	1.2.3.7.9.12.16	ICP-OES
	4	ICP-MS
	5	XRF
	6	Spectrophotometry, molybdenum blue, without extraction
	8.10.15	Spectrophotometry, phosphovanadomolybdate, extraction
	11	Gravimetry, ammonium phosphomolybdate
	13	Spectrophotometry, molybdenum blue, extraction
	14	Spectrophotometry, phosphovanadomolybdate, without extraction
Ni	1.2.3.5.7.8.10.11.13.14.16.17	ICP-OES
	4.6	FAAS
	9	Spectrophotometry, dimethylglyoxime, zinc oxide separation
	12.15	ICP-MS
Na	1.3.5.6.9.10.13.17	ICP-OES
	2.4.7.11.12.15.16	FAAS
	8	NAA
	14	ICP-MS
K	1.3.6.7.12.13	ICP-OES
	2.4.5.8.10.14.15.16	FAAS
	9	XRF
	11	NAA
Co	1.11	ICP-MS
	2.7	FAAS
	3	ETAAS
	4.5.9.10.12.13.14.15.16.18	ICP-OES
	6	Spectrophotometry, 2-nitroso-1-naphthol, without extraction
	8	NAA
Cu	1.2.3.4.6.7.11.12.14.15.16.18	ICP-OES
	8.17	ICP-MS
	9.10.13	FAAS
V	1.7	FAAS
	2.8	ICP-MS
	4.5.6.9.10.12.13.14.15	ICP-OES
	11	XRF
Pb	1.9	ETAAS
	2	FAAS
	3.5.7.8	ICP-MS
	4.10	ICP-OES
	6	FAAS, extraction with TOPO/KI/MIBK
Zn	1	ICP-MS
	2.3.5.7.8.11.12.14.15	ICP-OES
	4.6.9.10.13	FAAS

Element	*Line number*	*Analytical methods*
S	*1.2.4.5.7.9.10.11*	*Combustion, infrared absorption*
	3	*Gravimetry as $BaSO_4$ without separation*
	6.8	*Combustion, oxidation reduction titration*
Cr	*1.8*	*ICP-MS*
	2	*FAAS*
	3.5.6.7.9.10	*ICP-OES*
	4	*NAA*
Sn	*1.3.4.5*	*ICP-MS*
	2	*FAAS, extraction of iron*
	6	*ETAAS*

Abbreviations:

ETAAS	Electrothermal Atomic Absorption Spectrometry
FAAS	Flame Atomic Absorption Spectrometry
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometry
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
NAA	Neutron Activation Analysis
XRF	X-ray Fluorescence Spectrometry

DESCRIPTION OF THE SAMPLE

ECRM 688-1 is available in the form of a powder passing a 250 µm aperture sieve and is supplied in bottles containing 100 g.

INTENDED USE & STABILITY

ECRM 688-1 is intended for the verification of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments in cases where the calibration with primary substances (pure stoichiometric metals or compounds) is not possible and for establishing values for secondary reference materials.
It will remain stable provided that the bottle remains sealed and is stored in a cool, dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the content should become discoloured (e.g. oxidised) due to atmospheric contamination it should be discarded.

TRACEABILITY

The traceability of ECRM 688-1 has been established in accordance with principles of ISO Guides 30 – 35 and the International vocabulary of basic and general terms in metrology.
The characterisation of this material has been achieved by inter-laboratory study, each laboratory using the method of their choice, details of which are given above. These methods are either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds. Most methods used were either international or national standard methods or methods which are technically equivalent.

PARTICIPATING LABORATORIES

AG der Dillinger Hüttenwerke, Dillingen/Saar (Germany)
Alfred H Knight International Ltd, St Helens, Merseyside (UK)
ALS Scandinavia AB, Luleå (Sweden)
ArcelorMittal-Asturias, Bilbao (Spain)
BAM Bundesanstalt für Materialforschung und -prüfung, Berlin (Germany)
Böhler Edelstahl GmbH, Kapfenberg (Austria)
Carsid S.A, Marcinelle (Belgium)
Höganäs Sweden AB, Höganäs (Sweden)
Kanthal AB, Hallstahammar (Sweden)
Luxcontrol, Esch sur Alzette (Luxembourg)
Ovako Hofors AB, Hofors (Sweden)
Pattinson & Stead (2005) Ltd., Middlesbrough (UK)
Rautaruukki Oyj, Raahe (Finland)
Ridsdale & Co. Ltd., Middlesbrough (UK)
SSAB, Oxelösund (Sweden)
Swerea KIMAB AB, Stockholm (Sweden)
Tata Steel, IJmuiden, (Netherlands)
Tata Steel, Llanwern, (UK)
Tata Steel, Port Talbot (UK)
Tata Steel, Scunthorpe (UK)
voestalpine Stahl GmbH, Linz (Austria)

FURTHER INFORMATION

For information regarding the preparation, certification and supply of these European Certified Reference Materials (EURONORM-CRMs) and the use of the statistical information given on this certificate, please refer either to the producer of this Certified Reference Material or to Technical Reports CEN/TR 10317:2009 and CEN/TR 10350:2009, both of which are available from the national standards body in your country. (In the UK this is the BSI, 389 Chiswick High Road, London W4 4AL).

Further information and advice on this or other Certified Reference Materials or Reference Materials produced by Swerea KIMAB AB, may be obtained from the address below.

Angaben über Herstellung, Zertifizierung und Bezugsmöglichkeiten dieser Europäischen Zertifizierten Referenzmaterialien (EURONORM-ZRM) sowie über die Anwendungen der in diesem Zertifikat enthaltenen statistischen Daten sind erhältlich beim Hersteller dieses zertifizierten Referenzmaterials, dessen Adresse auf diesem Zertifikat angegeben ist oder sie finden sich in den CEN-Reports CEN/TR 10317 und CEN/TR 10350, beide zu beziehen durch die nationalen Normenorganisationen (in Deutschland bei der Vertriebsstelle des DIN: Beuth-Verlag GmbH, Burggrafenstraße 4-10, 10787 Berlin).

Weitere Informationen und Hinweise zu diesem oder anderen durch Swerea KIMAB AB hergestellten zertifizierten Referenzmaterialien oder Referenzmaterialien können unter der unten angegebenen Adresse erhalten werden.

Pour disposer d'informations sur la fabrication, la certification et la distribution des Matériaux de Référence Certifiés Européens (EURONORM-MRC) ainsi que sur l'utilisation des informations statistiques données sur ce certificat, se reporter soit au producteur de ce Matériau de Référence Certifié, soit aux Rapports Techniques CEN/TR 10317:2009 et CEN/TR 10350:2009. On peut se procurer ces deux documents auprès des organismes nationaux de normalisation. (Pour la France: AFNOR, 11 Avenue Francis de Pressensé, 93571 – St Denis la Plaine Cedex).

D´autres informations et avis au sujet de ce Matériau de Référence Certifié, ou de tout autre Matériau de Référence Certifié ou Matériau de Référence produit par le Swerea KIMAB AB, peuvent être demandés en contactant l´adresse figurant dans le bas de ce Certificat.

För information angående tillverkning, certifiering och anskaffning av dessa europeiska certifierade referensmaterial (EURONORM CRM) och för användning av statistisk information, som angivits i detta certifikat, refereras antingen till producenten av detta certifierade referensmaterial eller till Teknisk Rapport CEN/TR 10317:2009 och CEN/TR 10350:2009 som kan erhållas från den nationella standardiseringsorganisationen. (Sverige: SIS, S:t Paulsgatan 6, SE-118 80 Stockholm, Finland: SFS, PL. 116, FIN-002 41, Helsingfors, Danmark: DS, Kollegievej 6, DK-Charlottenlund 2920, Norge: NSF, Drammensveien, 145 A, Postboks 353 Skøyen, NO-0213 Oslo, Island: STRI, Holtagardar, IS-104 Reykjavik).

Ytterligare information och rådfrågan om detta eller andra Certifierade Referensmaterial/Referensmaterial, producerade av Swerea KIMAB AB, kan erhållas från angiven adress enligt nedan.

Rein Vainik
Research leader in Analytical Chemistry

Swerea KIMAB AB
Drottning Kristinas väg 48
SE 114 28 Stockholm, Sweden
E-mail: crm@swerea.se
Website: www.swereakimab.se