ECISS

EUROPEAN COMMITTEE FOR IRON AND STEEL STANDARDISATION
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. 682-2 Iron Ore

LABORATORY MEANS (4 Values)
mass content in %

Line No	Fe	Si	Mg	Al	Ti	Mn	P	S	V	Cu	Pb
1	65.820	0.7930	—	0.3095	0.0417	0.0295	0.0498	0.0108	0.0010	0.00025	0.00024
2	65.875	0.8188	0.0121	0.3100	0.0420	0.0295	0.0503	0.0116	0.0010	0.00025	0.00025
3	66.007	0.8192	0.0123	0.3101	0.0428	0.0296	0.0513	0.0124	0.0011	0.00035	0.00025
4	66.025	0.8237	0.0125	0.3120	0.0429	0.0300	0.0516	0.0128	0.0013	0.00043	0.00033
5	66.025	0.8261	0.0126	0.3157	0.0433	0.0306	0.0524	0.0130	0.0014	0.00048	0.00040
6	66.050	0.8275	0.0129	0.3208	0.0436	0.0307	0.0525	0.0134	0.0014	0.00050	0.00040
7	66.057	0.8278	0.0129	0.3230	0.0438	0.0310	0.0527	0.0135	0.0014	0.00050	0.00045
8	66.112	—	0.0134	0.3238	0.0442	0.0310	0.0532	0.0143	0.0015	0.00051	0.00045
9	66.117	0.8350	0.0134	0.3243	0.0442	0.0312	0.0533	0.0150	0.0016	0.00051	0.00048
10	66.139	0.8355	0.0137	—	0.0443	0.0313	0.0533	0.0152	0.0016	0.00068	0.00058
11	66.193	0.8358	0.0138	0.3282	0.0447	0.0315	0.0537	0.0154	0.0017	0.00073	
12	66.205	0.8392	0.0138	0.3288	0.0448	0.0316	0.0540	0.0155	0.0018	0.00073	
13	66.210	0.8497	0.0140	0.3325	0.0448	0.0318	0.0543	0.0164	0.0018		
14	66.269	0.8651	0.0143	0.3362	0.0471	0.0320	0.0547	0.0169	0.0019		
15	66.278	0.8678	0.0144	0.3374	0.0480	0.0323	0.0548		0.0020		
16	66.298		—	0.3450		0.0324	0.0550		—		
17	66.320		—	0.3454		0.0325					
18						—					
19											
M_M	**66.118**	**0.8332**	**0.0133**	**0.3252**	**0.0441**	**0.0311**	**0.0529**	**0.0140**	**0.0015**	**0.00049**	**0.00038**
s_M	0.144	0.0192	0.0008	0.0120	0.0017	0.0010	0.0016	0.0019	0.0004	0.00017	0.00012
s_W	0.068	0.0112	0.0006	0.0054	0.0010	0.0006	0.0010	0.0006	0.0001	0.00011	0.00011

Ca	*Co*	*Zn*	*Na*	*Cr*	*Hg (µg/g)*
0.0022	*<0.0001*	*0.0005*	*0.0008*	—	*0.058*
0.0025	*0.0001*	*0.0007*	*0.0010*	*0.0009*	*<0.1*
0.0044	*0.0001*	*0.0008*	*0.0011*	*0.0015*	*<0.5*
—	*0.0002*	*<0.0010*	*0.0020*	*0.0015*	*<1*
<0.0060	*0.0002*	*0.0010*	*0.0025*	*0.0016*	*<1*
0.0063	*0.0002*	*0.0010*	*0.0033*	*0.0017*	
0.0071	*0.0005*	*0.0011*	—	*0.0017*	
0.0080	*0.0006*	*0.0012*	*0.0037*	*0.0018*	
0.0081	*0.0008*	*0.0014*	—	*0.0018*	
0.0085	—	*0.0017*		*<0.0020*	
0.0090	*<0.0010*	—		—	
0.0094	*<0.0027*	*0.0018*		—	
0.0103		*0.0019*			
0.0143		*0.0021*			
		0.0026			

Additional Information from one laboratory: Loss on Ignition at 900°C: 3.01% (m/m) Combined water: 2.59% (m/m)

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.

CERTIFIED VALUES
Mass content in %

	Fe	Si	Mg	Al	Ti	Mn	P	S	V	Cu	Pb
M_M	**66.12**	**0.833**	**0.0133**	**0.325**	**0.0441**	**0.0311**	**0.0529**	**0.0140**	**0.0015**	**0.0005**	**0.0004**
C(95%)	0.08	0.012	0.0005	0.007	0.0010	0.0006	0.0009	0.0011	0.0002	0.0002	0.0001

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:

BUREAU OF ANALYSED SAMPLES LIMITED
Newham Hall, Middlesbrough, England TS8 9EA
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 organizations. (France – IRSID/CTIF, Germany – Iron and Steel CRM Working Group: VDEh, BAM & MPI für Eisenforschung, Nordic Countries – Nordic CRM Working Group, UK – BAS Ltd.)

UKAS REFERENCE MATERIALS
4004

METHODS USED
EURONORM – CRM No. 682-2

Element	Line Number	Methods
Fe	1-3-5-7-11-13-15-16-17	Titration with Cr (VI) after reduction with Sn (II)
	2-4-8-12	X-ray fluorescence spectrometry
	6	Titration with Cr (VI) after reduction with Ti (III)
	9-10	Titration with Mn (VII) after reduction with Ti (III)
	14	Titration with Mn (VII) after reduction with Sn (II)
Si	1-4-7-11-12-13	Gravimetry, dehydration with perchloric acid
	2	Gravimetry, photometric determination of residual Si in the filtrate
	3-5-9-10	X-ray fluorescence spectrometry
	6-14	Flame atomic absorption spectrometry
	15	Inductively coupled plasma - optical emission spectrometry
Mg	2-3-4-5-6-7-10-11-13	Inductively coupled plasma - optical emission spectrometry
	8	Inductively coupled plasma - mass spectrometry
	9-12-14-15	Flame atomic absorption spectrometry
Al	1-4-6-7-8-9-15-17	Inductively coupled plasma - optical emission spectrometry
	2-3-5-12	Flame atomic absorption spectrometry
	11-13-14-16	X-ray fluorescence spectrometry
Ti	1-3-7-8-9-10-12	Inductively coupled plasma - optical emission spectrometry
	2-5-6-13-15	X-ray fluorescence spectrometry
	4	Flame atomic absorption spectrometry
	11	Inductively coupled plasma - mass spectrometry
	14	Specrophotometry, chromotropic acid, without separation
Mn	1-2-4-12-13-16-17	Inductively coupled plasma - optical emission spectrometry
	3-6-11-14	Flame atomic absorption spectrometry
	5-7-8-10-15	X-ray fluorescence spectrometry
	9	Neutron activation analysis
P	1-8-14	Photometry, phosphovanadomolybdate, extraction
	2-4-6-7-12	Inductively coupled plasma - optical emission spectrometry
	3-5-9	Photometry, molybdenum blue, without extraction
	10-11-13-15-16	X-ray fluorescence spectrometry
S	1-3-5-7-8-9-10-11-12	Combustion, infrared absorption
	2	Spectrophotometry, methylene blue, evolution as H_2S in hypophosphoric and formic acid medium
	4-6	Combustion, oxidation reduction titration
	13	Inductively coupled plasma - optical emission spectrometry
	14	Gravimetry as $BaSO_4$ without separation
V	1-2-4-5-6-8-9-11-13-15	Inductively coupled plasma - optical emission spectrometry
	3	Flame atomic absorption spectrometry
	7	Spectrophotometry, N-benzoylphenylhydroxylamine, extraction
	10-12	Inductively coupled plasma - mass spectrometry
	14	X-ray fluorescence spectrometry
Cu	1-5-6	Flame atomic absorption spectrometry
	2-3-4-10-11-12	Inductively coupled plasma - optical emission spectrometry
	7-8-9	Inductively coupled plasma - mass spectrometry
Pb	1-2-3-4	Inductively coupled plasma - mass spectrometry
	5	Flame atomic absorption spectrometry, extraction with tri-octylphosphine oxide/KI/4-methyl pentan-2-one
	6-10	Electrothermal atomic absorption spectrometry
	7-8	Inductively coupled plasma - optical emission spectrometry
	9	Flame atomic absorption spectrometry
Ca	*1-2-3-6-9-10-12*	*Inductively coupled plasma - optical emission spectrometry*
	5-8-11-13	*Flame atomic absorption spectrometry*
	7-14	*X-ray fluorescence spectrometry*
Co	*1-5-6-7-9*	*Inductively coupled plasma - optical emission spectrometry*
	2	*Neutron activation analysis*
	3-11	*Inductively coupled plasma - mass spectrometry*
	4-8	*Flame atomic absorption spectrometry*
	12	*X-ray fluorescence spectrometry*
Zn	*1-2-3-13-15*	*Flame atomic absorption spectrometry*
	4	*X-ray fluorescence spectrometry*
	5-6-10-12-14	*Inductively coupled plasma - optical emission spectrometry*
	7-8-9	*Inductively coupled plasma - mass spectrometry*
Na	*1*	*Neutron activation analysis*
	2	*Inductively coupled plasma - optical emission spectrometry*
	3-4-5-6	*Flame atomic absorption spectrometry*
	8	*X-ray fluorescence spectrometry*

Element	Line Number	Methods
Cr	*2*	*Inductively coupled plasma - mass spectrometry*
	3-5-8	*Inductively coupled plasma - optical emission spectrometry*
	4	*Neutron activation analysis*
	6	*Flame atomic absorption spectrometry*
	7	*Electrothermal atomic absorption spectrometry*
	9-10	*X-ray fluorescence spectrometry*
Hg	*1-2-4*	*Atomic absorption spectrometry, cold vapour*
	3-5	*Inductively coupled plasma - mass spectrometry*

PARTICIPATING LABORATORIES

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Ridsdale & Co Ltd., Middlesbrough, UK
Rautaruukki Oy, Raahe, Finland
Swerea KIMAB, Stockholm, Sweden
ThyssenKrupp Steel AG, Duisberg,Germany
voestalpine Stahl GmbH, Linz, Austria

DESCRIPTION OF THE SAMPLE

The sample is available in the form of a powder passing a nominal 125 µm aperture. It is supplied in bottles containing 100 g.

INTENDED USE & STABILITY

The sample, ECRM 682-2, 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 metals or stoichiometric 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 contents should become discoloured (e.g. oxidised) by atmospheric contamination they should be discarded.

TRACEABILITY

The traceability of ECRM 682-2 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.

FURTHER INFORMATION

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