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. 879-1 Basic Slag

LABORATORY MEANS (4 Values)

mass content in %, related to the dried (105°C) sample

Line No	Si	Ti	Al	Fe	Ca	Mg	Cr	Mn	V	P (Total)	P (Cit. sol)	S	F	*%P (Form. sol)*
1	—	—	0.4000	18.65	30.84	1.268	—	—	0.3925	—	3.130	—	0.3100	*2.266*
2	4.075	0.3088	0.4025	18.74	30.93	1.290	0.3000	3.378	0.4025	3.642	3.195	0.0922	0.3154	*2.314*
3	4.075	0.3158	0.4050	18.77	31.04	1.290	0.3085	3.379	0.4030	3.644	3.228	0.0930	0.3250	*2.330*
4	4.095	0.3165	0.4062	18.80	31.05	1.294	0.3100	3.388	0.4045	3.661	3.273	0.0942	0.3340	*2.353*
5	4.100	0.3173	0.4080	18.82	31.08	1.295	0.3110	3.404	0.4068	3.662	3.277	0.0952	0.3412	*2.483*
6	4.104	0.3175	0.4100	18.82	31.11	1.297	0.3110	3.412	0.4068	3.663	3.290	0.0962	0.3438	*2.536*
7	4.110	0.3182	0.4128	18.83	31.12	1.305	0.3208	3.412	0.4070	3.665	3.292	0.0966	0.3469	*2.545*
8	4.112	0.3190	0.4172	18.86	31.12	1.314	0.3233	3.428	0.4075	3.665	3.302	0.0968	0.3502	*2.558*
9	4.116	0.3200	0.4192	18.89	31.14	1.314	0.3245	3.431	0.4122	3.668	3.305	0.0981	0.3505	*2.623*
10	4.124	0.3202	0.4248	18.90	31.15	1.315	0.3262	3.434	0.4125	3.676	3.330	0.1005	0.3662	*2.702*
11	4.124	0.3202	0.4294	18.92	31.16	1.318	0.3300	3.452	0.4175	3.693	3.352	0.1008	0.3722	*2.742*
12	4.125	0.3205	0.4300	18.96	31.18	1.318	0.3308	3.458	0.4177	3.695	3.360	0.1010	0.3725	
13	4.136	0.3212	0.4308	19.00	31.22	1.320	0.3320	3.460	0.4181	3.705	3.360	0.1020	0.3775	
14	4.136	0.3220	0.4349	19.02	31.25	1.321	0.3350	3.456	0.4189	3.705	3.504	0.1035	0.3812	
15	4.140	0.3239	0.4370	19.04	31.49	1.335	0.3355	3.470	0.4200	3.706	3.505	0.1042	0.3838	
16	4.140	0.3245	0.4400	19.05	31.49	1.338	0.3355	3.478	0.4265	3.720	—	0.1072	0.3910	
17	4.148	0.3250	0.4400	19.23	31.50	1.340	0.3358	3.480	0.4290	3.725		0.1138	0.3910	
18	4.158	0.3258	0.4420	19.25	31.70	1.340	0.3375	3.481	0.4340	3.725		0.1152	0.3932	
19	4.160	0.3275	0.4422	19.26	31.82	1.354	0.3390	3.500	0.4370	3.746		0.1175	0.4158	
20	4.168	0.3290	0.4481	19.27	—	1.361	0.3488	3.520	—	3.752		—	0.4325	
21	—	0.3330	0.4538	19.27	—	1.369	—	3.537	—	—			0.4362	
M_M	**4.123**	**0.3213**	**0.4254**	**18.97**	**31.23**	**1.319**	**0.3261**	**3.448**	**0.4144**	**3.690**	**3.314**	**0.1016**	**0.3681**	*2.496*
s_M	0.027	0.0054	0.0164	0.20	0.26	0.026	0.0129	0.045	0.0116	0.034	0.100	0.0076	0.0353	

M_M: Mean of the intralaboratory means, s_M: Standard deviation of the intralaboratory means

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 %

	Si	Ti	Al	Fe	Ca	Mg	Cr	Mn	V	P (Total)	P (Cit. sol)	S	F
M_M	**4.12**	**0.321**	**0.425**	**18.97**	**31.23**	**1.32**	**0.326**	**3.45**	**0.414**	**3.69**	**3.31**	**0.102**	**0.368**
C(95%)	0.02	0.003	0.008	0.09	0.13	0.02	0.007	0.03	0.006	0.02	0.06	0.004	0.017

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

Mass content in % expressed as oxides

	SiO_2	TiO_2	Al_2O_3	CaO	MgO	Cr_2O_3	MnO	V_2O_5	P_2O_5 (Total)	P_2O_5 (Cit. sol)
M_M	**8.82**	**0.535**	**0.803**	**43.70**	**2.19**	**0.477**	**4.45**	**0.738**	**8.46**	**7.59**

PARTICIPATING LABORATORIES

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This certified 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: Stahlinstitut VDEh, BAM Bundesanstalt für Materialforschung und –prüfung & MPI für Eisenforschung, UK – BAS Ltd.)

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The current edition of this certificate is available at www.basrid.co.uk

EURONORM – CRM No. 879-1

METHODS USED

Element	Line Number	Methods
Si	2-3-4-5-9-10-14-17-18-19-20	Gravimetric, dehydration with perchloric acid
	6-12	Photometric as molybdenum blue
	7-15	Atomic absorption spectrometry
	8-16	Gravimetric, dehydration with hydrochloric acid
	11-13	X-ray fluorescence spectrometry
Ti	2-10-17-19	Atomic absorption spectrometry
	3-20	X-ray fluorescence spectrometry
	4-7-8-11-15-21	Photometric with chromotropic acid
	5-6-12-13-16-18	Photometric with diantipyrylmethane
	9	Photometric with hydrogen peroxide
	14	Photometric with hydrogen peroxide, cupferron separation
Al	1-2-5-6-8-10-12-14-16-17-19-20-21	Atomic absorption spectrometry
	4-15	X-ray fluorescence spectrometry
	3-18	Photometric with eriochrome cyanine
	7-11	Photometric with chromazurol S
	9	Gravimetric as aluminium phosphate
	13	Bromometric titration, precipitation with 8 hydroxyquinoline
Fe	1-3-4-7-8-9-10-11-12-13-14-15-17-18-19-21	Titrimetric with dichromate
	2-20	X-ray fluorescence spectrometry
	5-6	Photometric with 1:10 phenanthroline
	16	Titrimetric with permanganate
Ca	1-8-10-11-13-15-16-18	Titrimetric with permanganate, oxalate precipitation
	2-5-6	Atomic absorption spectrometry
	3-4-9-12-17	Complexometric titration
	7-19	X-ray fluorescence spectrometry
	14	Complexometric titration, precipitation with oxalate
Mg	1-3-4-5-7-8-9-10-12-13-14-15-17-19-20	Atomic absorption spectrometry
	2-6	X-ray fluorescence spectrometry
	11-16-21	Gravimetric as magnesium ammonium phosphate
	18	Gravimetric as magnesium pyrophosphate
Cr	2-4-6-7-8-9-10-11-12-14-15-16-18-20	Atomic absorption spectrometry
	3-5	Photometric with diphenylcarbazide
	13	Titrimetric, oxidation with persulphate/silver nitrate
	17	Titrimetric, oxidation with persulphate/silver nitrate, potentiometric end point
	19	X-ray fluorescence spectrometry
Mn	2-4-10-12-13-17-19-20-21	Atomic absorption spectrometry
	3-5-6-7-8-11-14	Photometric, oxidation with periodate
	9-18	X-ray fluorescence spectrometry
	15-16	Photometric, oxidation with persulphate/silver nitrate
V	1-2-3-5-6-7-8-12-14-15-16-18	Atomic absorption spectrometry
	4	X-ray fluorescence spectrometry
	9	Titrimetric with ammonium ferrous sulphate
	10-17	Photometric with N-benzoylphenyl-hydroxylamine with extraction
	11	Photometric with dimethyl naphthidine
	13	Titration with ammonium ferrous sulphate, potentiometric end point
	19	Photometric as phosphovanadotungstate
P (Total)	2-15	X-ray fluorescence spectrometry
	3-7-12-13-19-20	Photometric as molybdenum blue
	4-6-10-14-18	Photometric as phosphovanadomolybdate
	5	Photometric as phosphovanadomolybdate with extraction
	8	Gravimetric as quinolinium phosphomolybdate
	9-16-17	Titrimetric as phosphomolybdate
	11	Titrimetric as quinolinium phosphomolybdate
P (Extraction with 2% citric acid solution)	1	Titrimetric as quinolinium phosphomolybdate
	2-8	Titrimetric as phosphomolybdate
	3-4-5-6-9-10-12	Photometric as phosphovanadomolybdate
	7-14	Photometric as phosphovanadomolybdate with extraction
	11	Gravimetric as phosphomolybdate
	13	Photometric as molybdenum blue
	15	Gravimetric as quinolinium phosphomolybdate
S	2	Combustion, conductimetric
	3-8-16	Combustion, infrared absorption
	4-6-12-18-19	Gravimetric as barium sulphate
	5-7-9-10-11-13-14-15-17	Combustion, oxidation/reduction titration
F	1-2-5-7-8-9-20	Fusion, specific ion electrode
	3-12	Pyrohydrolysis, specific ion electrode
	4-14-17	Pyrohydrolysis, photometric with alizarin fluorine blue
	6-13-16-21	Distillation, specific ion electrode
	10-11-15-18-19	Distillation, photometric with alizarin fluorine blue
P (Extraction with 2% formic acid solution)	*1-2-8*	*Photometric as phosphovanadomolybdate*
	3-4-11	*Gravimetric as quinolinium phosphomolybdate*
	5	*Titrimetric as quinolinium phosphomolybdate*
	6	*Titrimetric as phosphomolybdate*
	7-9-10	*Photometric as phosphovanadomolybdate with extraction*

EURONORM – CRM No. 879-1

DESCRIPTION OF THE SAMPLE

The sample consists of material passing a sieve of nominal aperture size 150 µm and is supplied in bottles containing 100g

INTENDED USE & STABILITY

ECRM 879-1 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 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 879-1 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.

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 10317:2014 and CEN/TR 10350:2013, 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 Bureau of Analysed Samples Ltd. may be obtained from the address below.

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