

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. 196-2, 2 % Silicon Steel**

LABORATORY MEANS (4 values) - Mass content in %

Line No	C	Si	Mn	P	S	Cr	Mo	Ni	Al (tot)	As	B	Co	Cu
1	0.0052	---	0.3538	0.00265	0.00042	0.0253	0.0122	0.0364	0.2119	---	0.00005	0.0122	0.0051
2	0.0055	1.7804	0.3556	0.00273	0.00046	0.0264	0.0125	0.0381	0.2119	---	0.00009	0.0125	0.0051
3	0.0056	1.7829	0.3562	0.00330	0.00049	0.0264	0.0132	0.0382	0.2120	0.00027	0.00009	0.0131	0.0052
4	0.0057	1.7933	0.3588	0.00340	0.00051	0.0267	0.0137	0.0382	0.2129	0.00029	0.00010	0.0133	0.0052
5	0.0057	1.7966	0.3592	0.00345	0.00057	0.0268	0.0139	0.0383	0.2131	0.00030	0.00010	0.0135	0.0054
6	0.0057	1.8032	0.3597	0.00346	0.00058	0.0269	0.0139	0.0387	0.2139	0.00030	0.00013	0.0137	0.0055
7	0.0059	1.8057	0.3617	0.00353	0.00060	0.0270	0.0139	0.0389	0.2141	0.00030	0.00016	0.0137	0.0055
8	0.0060	1.8089	0.3632	0.00358	0.00061	0.0276	0.0141	0.0390	0.2146	0.00033	0.00017	0.0138	0.0055
9	0.0061	1.8120	0.3636	0.00363	0.00066	0.0289	0.0141	0.0397	0.2148	0.00035	0.00019	0.0138	0.0056
10	0.0061	1.8147	0.3640	0.00370	0.00069	0.0290	0.0143	0.0400	0.2161	0.00036	0.00020	0.0138	0.0056
11	0.0061	1.8150	0.3662	0.00376	0.00076	0.0290	0.0144	0.0405	0.2168	0.00037	0.00021	0.0140	0.0056
12	0.0063	1.8158	0.3670	---	0.00091	0.0291	0.0146	0.0406	0.2172	0.00037	---	0.0140	0.0057
13	0.0064	1.8185	0.3677	0.00380	0.00091	0.0292	0.0147	0.0410	0.2174	0.00038	---	0.0140	0.0057
14	0.0064	1.8270	0.3681	0.00409	0.00096	0.0293	0.0149	0.0410	0.2175	0.00038	---	0.0141	0.0058
15	0.0066	1.8389	0.3683	0.00424	---	0.0297	0.0150	0.0414	---	---	---	0.0141	0.0058
16	0.0069	---	0.3702	0.00442	---	0.0298	0.0154	0.0418	0.2208	---	---	0.0144	0.0060
17	---	---	0.3725	0.00448	---	0.0299	0.0166	0.0421	0.2238	---	---	0.0148	0.0061
18	---	---	---	0.00450	---	0.0301	---	0.0436	0.2238	---	---	0.0150	0.0061
19	---	---	0.3732	---	---	---	---	0.0436	0.2274	---	---	---	0.0061
20	---	---	0.3748	---	---	---	---	---	---	---	---	---	0.0062
21	---	---	---	---	---	---	---	---	---	---	---	---	0.0064
22	---	---	---	---	---	---	---	---	---	---	---	---	0.0064
<b>M<sub>M</sub></b>	<b>0.0060</b>	<b>1.8079</b>	<b>0.3644</b>	<b>0.00369</b>	<b>0.00065</b>	<b>0.0282</b>	<b>0.0142</b>	<b>0.0401</b>	<b>0.2167</b>	<b>0.00033</b>	<b>0.00014</b>	<b>0.0138</b>	<b>0.0057</b>
<b>S<sub>M</sub></b>	0.0005	0.0161	0.0062	0.00055	0.00018	0.0016	0.0011	0.0020	0.0046	0.00004	0.00006	0.0007	0.0004
<b>S<sub>w</sub></b>	0.0003	0.0109	0.0024	0.00017	0.00009	0.0006	0.0004	0.0007	0.0017	0.00004	0.00003	0.0002	0.0002

Line No	N	Sn	Ti	V	Ca	Mg	Zn
1	0.00142	---	0.00190	---	0.00045	0.00053	0.00007
2	0.00147	0.00032	0.00219	0.00325	0.00046	0.00064	0.00011
3	0.00147	0.00038	0.00228	---	0.00047	0.00065	0.00015
4	0.00158	0.00040	0.00237	0.00335	0.00060	0.00066	0.00017
5	0.00163	0.00043	0.00240	0.00350	0.00066	0.00066	0.00018
6	0.00164	0.00045	0.00241	0.00351	0.00068	0.00070	0.00019
7	0.00170	0.00045	0.00244	0.00355	0.00075	0.00074	0.00019
8	0.00174	0.00045	0.00251	0.00358	0.00078	0.00078	0.00020
9	0.00177	0.00051	0.00254	0.00359	0.00081	0.00080	0.00020
10	0.00179	0.00053	0.00257	0.00361	0.00082	0.00083	0.00021
11	0.00180	0.00054	0.00259	0.00362	0.00085	0.00083	0.00023
12	0.00188	0.00055	0.00265	0.00368	0.00089	0.00086	0.00023
13	0.00188	0.00063	0.00265	0.00370	0.00095	0.00090	0.00025
14	0.00192	---	0.00270	0.00373	---	0.00092	0.00027
15	0.00218	---	0.00274	0.00374	---	---	---
16	0.00220	---	0.00275	0.00386	---	---	---
17	0.00224	---	0.00280	0.00401	---	---	---
18	---	---	0.00310	0.00405	---	---	---
19	---	---	---	0.00418	---	---	---
20	---	---	---	---	---	---	---
21	---	---	---	---	---	---	---
22	---	---	---	---	---	---	---
<b>M<sub>M</sub></b>	<b>0.00178</b>	<b>0.00047</b>	<b>0.00253</b>	<b>0.00368</b>	<b>0.00071</b>	<b>0.00075</b>	<b>0.00019</b>
<b>S<sub>M</sub></b>	0.00025	0.00009	0.00027	0.00025	0.00017	0.00012	0.00006
<b>S<sub>w</sub></b>	0.00011	0.00004	0.00010	0.00008	0.00009	0.00004	0.00004

M<sub>M</sub>: Mean of the intralaboratory means

S<sub>M</sub>: Standard deviation of the intralaboratory means

S<sub>w</sub>: 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 reported as "less than" by the participating laboratories have not been taken into account in the statistical calculations.

Additional values from laboratories for information (in µg/g)

Bi: 0.01, <0.02, Ga: 39, Ge: 3, Hf: 0.05, Nb: 0.6, Pb: 0.5, Sb: 2, Ta: <0.02, Th: 0.04, U: 0.04, W: 0.4, Y: 0.03, Zr: 2, 2.6

**CERTIFIED VALUES - Mass content in %**

	C	Si	Mn	P	S	Cr	Mo
<b>M<sub>M</sub></b>	<b>0.0060</b>	<b>1.808</b>	<b>0.364</b>	<b>0.00369</b>	<b>0.00065</b>	<b>0.0282</b>	<b>0.0142</b>
<b>C(95 %)</b>	<b>0.0003</b>	<b>0.010</b>	<b>0.003</b>	<b>0.00028</b>	<b>0.00011</b>	<b>0.0008</b>	<b>0.0006</b>

  

	Ni	Al (tot)	As	B	Co	Cu	N
<b>M<sub>M</sub></b>	<b>0.0401</b>	<b>0.2167</b>	<b>0.00033</b>	<b>0.00014</b>	<b>0.0138</b>	<b>0.0057</b>	<b>0.00178</b>
<b>C(95 %)</b>	<b>0.0010</b>	<b>0.0023</b>	<b>0.00003</b>	<b>0.00004</b>	<b>0.0004</b>	<b>0.0002</b>	<b>0.00013</b>

  

	Sn	Ti	V	Ca	Mg	Zn
<b>M<sub>M</sub></b>	<b>0.00047</b>	<b>0.00253</b>	<b>0.00368</b>	<b>0.00071</b>	<b>0.00075</b>	<b>0.00019</b>
<b>C(95 %)</b>	<b>0.00006</b>	<b>0.00014</b>	<b>0.00013</b>	<b>0.00011</b>	<b>0.00007</b>	<b>0.00004</b>

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

**swerea | KIMAB**

Isafjordsgatan 28A, SE 164 40, Kista, 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- ArcelorMittal Maizières/CTIF; Germany-Iron and Steel CRM Working Group: Stahlinstitut VDEh,  
BAM Bundesanstalt für Materialforschung und -prüfung & MPI für Eisenforschung;  
Nordic Countries-Nordic CRM Working Group)



FEBRUARY 2014

EURONORM – CRM No. 196-2  
METHODS USED

Element	Line number	Methods
C	1.2.3.4.5.7.8.9.10.11.13.15.16	Combustion, infrared absorption
	6	Combustion, coulometric titration
	12	Combustion, non-aqueous titration after absorption in organic solvent
	14	Combustion, gravimetry
Si	2.3.4.7.8.12.14.15	ICP-OES
	5.6.9.10.11.13	Gravimetry, dehydration with perchloric acid
Mn	1.2.3.4.6.7.8.9.11.13.14.16.17.19	ICP-OES
	5.12	MAS, periodate oxidation
	10.15	ICP-MS
	20	GD-MS
P	1.2.5.7.10.13.14.16.17	ICP-OES
	3	MAS, molybdenum blue, extraction
	4.11.15.18	MAS, phosphovanadomolybdate, extraction
	6.8	ICP-MS
S	1.2.4.5.6.7.8.9.10.11.13.14	Combustion, infrared absorption
	3	GD-MS
	12	MAS, methylene blue, evolution as H <sub>2</sub> S in hypophosphoric and formic acid medium
Cr	1.3.4.5.6.7.8.9.10.11.13.14.15	ICP-OES
	2	FAAS
	12	GD-MS
	16.17.18	ICP-MS
Mo	1.2.3.5.6.8.9.10.11.12.13.14.17	ICP-OES
	4.7.15.16	ICP-MS
Ni	1.2.3.4.6.7.8.9.10.11.13.14.16.19	ICP-OES
	5.12.18	ICP-MS
	15	FAAS
	17	GD-MS
Al (tot)	1.2.3.4.5.6.7.8.9.10.12.13.14.16.17.18	ICP-OES
	11.19	ICP-MS
As	3	GD-MS
	4.8	MAS, diethyldithiocarbamate, separation as arsine
	5.7.12.13	ICP-MS
	6.11	ETAAS
	9.14	ICP-OES
10	ICP-OES, evolution as arsine	
B	1	ICP-OES
	2.7.9.11	MAS, curcumin
	3.4.5.6.8.10	ICP-MS
Co	1.7.10.12.15.18	ICP-MS
	2.3.4.5.8.9.11.13.14.17	ICP-OES
	6	FAAS
	16	GD-MS
Cu	1.2.10.11.19	ICP-MS
	3	GD-MS
	4.5.7.8.9.12.13.14.16.18.21.22	ICP-OES
	6.15.17.20	FAAS
N	1.2.3.4.5.6.7.8.9.10.11.12.14	Thermal conductivity, decomposition in graphite crucible
	13	MAS, Nessler reagent, distillation
	15.16	Acidimetric titration after distillation, visual end point
	17	MAS, bispyrazolone, distillation
Sn	2.3.7.9.10.11	ICP-MS
	4.5.12.13	ICP-OES
	6	ETAAS
	8	GD-MS
Ti	1.2.3.4.5.6.8.9.11.16.17.18	ICP-OES
	7.10.12.13.15	ICP-MS
	14	GD-MS
V	2.5.7.8.9.11.13.14.15.16.17.18.	ICP-OES
	4.6.10.12	ICP-MS
	19	GD-MS
Ca	1.2.4.5.7.8.9.11.12	ICP-OES
	3.13	ICP-MS
	6	GD-MS
	10	FAAS
Mg	1.5.6.7.8.9.12.13.14	ICP-OES
	2.3.10	ICP-MS
	4	GD-MS
	11	FAAS
Zn	1.3.5.11.14	ICP-OES
	2.6.7.9.10.12	ICP-MS
	4.8.13	FAAS

**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
GD-MS	Glow Discharge – Mass Spectrometry
MAS	Spectrophotometry

**DESCRIPTION OF THE SAMPLE**

The sample consists of chips passing a nominal 2000 µm aperture sieve from which the fines passing a nominal 250 µm sieve have been removed. It is supplied in bottles containing 100 g. It is also supplied in the form of 38 mm dia. discs.

**INTENDED USE & STABILITY**

ECRM 196-2 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 content should become discoloured (e.g. oxidised) due to atmospheric contamination it should be discarded.

The solid (disc) sample, ECRM 196-2, is intended for establishing and checking the calibration of Optical Emission and X-ray Spectrometers for the analysis of samples of similar materials. The “as received” working surface of the sample should be lished before use to remove any protective coating. It will remain stable provided that it is not subjected to excessive heat (e.g. during preparation of the working surface).

**TRACEABILITY**

**The traceability of ECRM 196-2 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.

**PARTICIPATING LABORATORIES**

AG der Dillinger Hüttenwerke, Dillingen/Saar (Germany)  
 ALS Scandinavia AB, Luleå (Sweden)  
 ArcelorMittal Maizières Research SA, Maizières-lès-Metz (France)  
 ArcelorMittal, Dunkerque (France)  
 ArcelorMittal, Florange (France)  
 Aubert & Duval, Les Ancizes (France)  
 BAM Bundesanstalt für Materialforschung und -prüfung, Berlin (Germany)  
 CTIF, Sèvres (France)  
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**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 10317:2013 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 Swerea KIMAB AB, may be obtained from the address below.

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