

**ECIIS**  
**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. 585-2 High Carbon Ferro-Chromium**

LABORATORY MEANS (4 Values)  
mass content in %

Line No	C	Si	Mn	P	S	Cr	Ni	Co	N	Ti	V	Fe
1	5.4255	—	0.7755	—	0.0273	—	0.2614	0.0566	0.0106	0.2443	0.2338	38.438
2	5.4332	4.5819	0.7785	0.0208	0.0288	48.907	0.2785	0.0573	0.0112	0.2448	0.2495	38.518
3	5.4532	4.5890	0.7800	0.0220	0.0294	48.908	0.2835	0.0595	0.0113	0.2513	0.2603	38.534
4	5.4613	4.5968	0.7810	0.0226	0.0298	48.932	0.2847	0.0602	0.0116	0.2545	0.2645	38.538
5	5.4640	4.6518	0.7853	—	0.0302	48.941	0.2861	0.0603	0.0119	0.2546	0.2702	38.551
6	5.4676	4.6550	0.7908	0.0243	0.0310	48.963	0.2876	0.0607	0.0123	0.2570	0.2716	38.554
7	5.4694	4.6958	0.7910	0.0247	0.0314	48.999	0.2876	0.0615	0.0126	0.2582	0.2750	38.570
8	5.4706	4.6975	0.7955	0.0256	0.0318	49.054	0.2940	0.0615	0.0127	0.2596	0.2823	38.711
9	5.4842	4.7038	0.7982	0.0258	0.0321	49.083	0.2945	0.0616	0.0129	0.2604	0.2844	38.721
10	5.4855	4.7098	0.8050	0.0260	0.0324	49.083	0.2953	0.0617	0.0129	0.2609	0.2848	38.753
11	5.4885	4.7108	0.8097	0.0264	0.0325	49.091	0.2973	0.0621	0.0130	0.2643	0.2853	38.765
12	5.4910	4.7395	0.8141	0.0269	0.0327	49.160	0.2993	0.0622	0.0130	0.2663	0.2916	38.903
13	5.4981	4.7419	0.8163	0.0270	—	49.185	—	0.0628	—	0.2669	0.2928	39.198
14	5.4983	4.7421	0.8179	0.0271	0.0332	49.215	0.3005	0.0635	0.0133	0.2691	0.2954	—
15	—	4.7550	0.8187	0.0275	0.0334	49.247	0.3033	—	0.0134	0.2712	0.2962	—
16	5.5137	4.7821	0.8287	0.0278	0.0341	—	0.3057	0.0655	0.0139	0.2749	0.2965	
17	5.5470	—	0.8360	0.0281	0.0345	—	0.3062	0.0656	0.0139	0.2789	0.2977	
18	5.5535	—	—	—	0.0353	—	0.3306	0.0660	0.0154	0.2920	0.2978	
19	5.5758	—	—	—	0.0355	—	—	0.0667	—	—	0.2995	
20	—	—	—	—	—	—	—	0.0669	—	—	0.3061	
$M_M$	5.4878	4.6902	0.8013	0.0255	0.0320	49.053	0.2939	0.0622	0.0127	0.2627	0.2818	38.673
$s_M$	0.0398	0.0627	0.0187	0.0023	0.0023	0.115	0.0147	0.0030	0.0012	0.0120	0.0188	0.205
$s_W$	0.0152	0.0269	0.0069	0.0009	0.0007	0.078	0.0034	0.0009	0.0004	0.0040	0.0033	0.124

$M_M$ : Mean of the intralaboratory means;  $s_M$ : Standard Deviation of the intralaboratory means.

$s_W$ : Intralaboratory standard deviation,  $s_b$ : Interlaboratory standard deviation,  $s_b = \sqrt{s_w^2 - (s_M^2 + 4)}$

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.

Additional Information from one laboratory: - Cu: 0.0060%

**CERTIFIED VALUES**  
Mass content in %

	C	Si	Mn	P	S	Cr	Ni	Co	N	Ti	V	Fe
$M_M$	5.488	4.69	0.801	0.0255	0.0320	49.05	0.294	0.0622	0.0127	0.263	0.282	38.67
C(95%)	0.020	0.04	0.010	0.0013	0.0012	0.07	0.008	0.0015	0.0007	0.006	0.009	0.13

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 ECIIS, 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.)



**METHODS USED**  
**EURONORM – CRM No. 585-2**

Element	Line Number	Methods
C	1-2-3-4-6-7-9 11-12-13-14-16-17-18-19 5-8 10	Combustion, infrared absorption Combustion, gravimetric Coulometric titration
Si	2 3-5-9 4-6-7-8-10-11-13-14-16 12 15	Flame atomic absorption spectrometry Inductively coupled plasma - optical emission spectrometry Gravimetry, dehydration with perchloric acid Gravimetry, dehydration with sulphuric acid X-ray fluorescence spectrometry
Mn	1-2-3-5-6-10-11-12-14-16 4 7-8-15-17 9-13	Inductively coupled plasma - optical emission spectrometry X-ray fluorescence spectrometry Flame atomic absorption spectrometry Photometric, periodate oxidation
P	2-16 3-9-14-17 4-11 6-7-8-10-13 12 15	Photometric, as molybdenum blue, with extraction Inductively coupled plasma - optical emission spectrometry Photometric, as molybdenum blue, without extraction Photometric, as phosphovanadomolybdate, with extraction Inductively coupled plasma - mass spectrometry X-ray fluorescence spectrometry
S	1 2-3-4-5-6-7-8-9-10-11-12-14-15-17-18-19 16	Gravimetry, as barium sulphate without separation Combustion, infrared absorption Combustion, acidimetric titration, absorption in H <sub>2</sub> O <sub>2</sub> or AgNO <sub>3</sub>
Cr	2-4-6-7-8-10-12-13-14 3-9 5-11 15	Titration with Fe (II), oxidation with persulphate Titration with Fe (II), oxidation with peroxide Inductively coupled plasma - optical emission spectrometry Iodometry, decomposition with peroxide
Ni	1-2-4-7-9-10-12-14-16-17-18 3-5-8-11 6 15	Inductively coupled plasma - optical emission spectrometry Flame atomic absorption spectrometry Photometric, with dimethylglyoxime, with extraction X-ray fluorescence spectrometry
Co	1-3-6-7-8-9-10-11-12-13-14-17-19-20 2-4-16 5 18	Inductively coupled plasma - optical emission spectrometry Flame atomic absorption spectrometry Inductively coupled plasma - mass spectrometry X-ray fluorescence spectrometry
N	1 2-3-4-5-6-7-8-9-10-11-12-14-15-16-17-18	Acidimetric titration after distillation, visual end point Thermal conductivity, decomposition in graphite crucible
Ti	1-3-4-5-8-9-10-11-12-14-15-16 2-18 6 7 13-17	Inductively coupled plasma - optical emission spectrometry Flame atomic absorption spectrometry X-ray fluorescence spectrometry Photometric, with diantipyrylmethane Inductively coupled plasma - mass spectrometry
V	1-2-6-7-8-9-10-12-13-14-15-16-19-20 3-11-17 4-5 18	Inductively coupled plasma - optical emission spectrometry Flame atomic absorption spectrometry Inductively coupled plasma - mass spectrometry X-ray fluorescence spectrometry
Fe	1-2-3 4 5-6-8-11-12 7 9 10 13	Titration with Cr (VI) after reduction with Sn (II) X-ray fluorescence spectrometry Inductively coupled plasma - optical emission spectrometry Photometric with 1-10 phenanthroline Titration with Mn (VII) after silver column reduction Titration with Mn (VII) after reduction with Sn (II) Flame atomic absorption spectrometry

## PARTICIPATING LABORATORIES

AG der Dillingen Hüttenwerke, Dillingen, Germany	Inspectorate International, Witham, UK
Acerinox SA, Algeciras, Spain	Kanthal AB, Hallstahammar, Sweden
Arcelor Atlantique et Lorraine, Dunkerque, France	Luxcontrol SA, Esh-sur-Alzette, Luxembourg
Aubert & Duval, Les Arcs, France	Outokumpu Stainless AB, Avesta, Sweden
Böhler Edelstahl GmbH & Co KG, Kapfenberg, Austria	Ovako Steel AB, Hofors, Sweden
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany	Pattinson and Stead (2005) Ltd., Middlesbrough, UK
Carsid SA, Couillet, Belgium	Ridsdale & Co Ltd., Middlesbrough, UK
Centro Nacional de Investigaciones Metalurgicas (CENIM), Madrid, Spain	Sandvik Materials Technology, Sandviken, Sweden
Corrosion and Metals Research Institute (KIMAB), Stockholm, Sweden	ThyssenKrupp Acciai speciali, Terni, Italy
CORUS Testing Solutions, Scunthorpe, UK	ThyssenKrupp Nirosta GmbH, Krefeld, Germany
CTIF, Sèvres, France	voestalpine Stahl GmbH, Linz, Austria
Deutsche Edelstahlwerke GmbH, Germany	

## DESCRIPTION OF THE SAMPLE

The sample is available in the form of a powder, prepared by use of a ball mill and passing a nominal 125 µm aperture. It is supplied in bottles containing 100 g.

## INTENDED USE & STABILITY

The sample, ECRM 585-2, 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 585-2 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

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 to CEN Report CR 10317 and ECISS Information Circular No. 5, both of which are available from the national standards body in your country or from CEN in Brussels. (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 may be obtained from the address below.

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, à l'adresse figurant sur ce Certificat soit au Rapport CEN CR 10317 et à la circulaire d'information No. 5 (ECISS). On peut se procurer ces deux documents auprès des organismes nationaux de normalisation ou auprès du CEN, Bruxelles. (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 produits par le Bureau Of Analysed Samples Ltd, peuvent être demandés en contactant l'adresse figurant dans le bas de ce Certificat.

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