

Certified European Reference Material (EURONORM CRM)

Certificate of chemical analysis

EURONORM-CRM No. 049-1 (unalloyed steel, No. 1.1237.01)

Laboratory means (4 values),
mass content in %

Line No.	C	S	N
1	-----	0.00353	0.00282
2	0.6914	0.00362	0.00290
3	0.6941	0.00381	0.00291
4	0.6946	0.00399	0.00296
5	0.6951	0.00399	0.00297
6	0.6953	0.00400	0.00309
7	0.6980	0.00400	0.00312
8	0.6999	0.00401	0.00313
9	0.7005	0.00403	0.00315
10	0.7039	0.00404	0.00318
11	0.7043	0.00421	0.00335
12	0.7050	0.00437	0.00336
13	0.7059	0.00446	0.00342
14	0.7073	0.00447	0.00362
15	0.7155		0.00363
M(M)	0.7008	0.00404	0.00317
s(M)	0.0066	0.00028	0.00025
s(w)	0.0023	0.00011	0.00013

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 omitted by either the Cochran or Grubbs test.

CERTIFIED VALUES, mass content in %

	C	S	N
M(M)	0.701	0.00404	0.00317
C(95%)	0.004	0.00017	0.00015

C(95%) is the half-width confidence interval where t is the appropriate Student's t value and n is the number of acceptable laboratory means. For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 sections 6.1 and 10.5.2.

$$C(95\%) = \frac{t \cdot s(M)}{\sqrt{n}}$$

This certified reference material was prepared and issued by:

The German Iron and Steel CRM Working Group

comprising of Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Max-Planck-Institut für Eisenforschung GmbH (MPI), Düsseldorf, Steel institute VDEh, Düsseldorf

after approval by all the participating laboratories and all the producing organisations: (France- ArcelorMittal Maizières/CTIF; Germany-Iron and Steel CRM Working Group: Steel institute VDEh, Bundesanstalt für Materialforschung und -prüfung (BAM) & MPI für Eisenforschung; Nordic Countries-Nordic CRM Working Group)

Berlin, October 2020

Description of the sample

The sample is available in the form of fine chips from which the fines passing a 0.25 mm sieve have been removed. It is supplied in glass bottles containing 100 g.

Sale of the reference material: Bundesanstalt für Materialforschung und -prüfung (BAM), Richard-Willstätter-Straße 11, 12489 Berlin (www.webshop.bam.de).

Participating laboratories

AB Sandvik Materials Technology, Sandviken (Sweden)
 AG der Dillinger Hüttenwerke, Dillingen/Saar (Germany)
 ArcelorMittal Maizières Research SA, Maizières-lès-Metz (France)
 Bruker AXS GmbH, Karlsruhe (Germany)
 Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany)
 Eltra GmbH, Haan (Germany)
 IFW Dresden e.V., Dresden (Germany)
 Institute of Certified Reference Materials, Yekaterinburg (Russia)
 LECO, Berlin (Germany)
 Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf (Germany)
 Saarstahl AG, Völklingen (Germany)
 ThyssenKrupp Steel Europe AG, Duisburg (Germany)
 voestalpine Stahl Linz GmbH, Linz (Austria)

Intended use & stability

ECRM 049-1 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 and dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the contents should become discoloured (eg. oxidised) due to atmospheric contamination they should be discarded.

This certificate is valid until there is a revocation from the producer of the material.

Traceability

The assigned values for this reference material are achieved by inter-laboratory characterization, each laboratory using the method of their choice, details of which are given below. 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.

Methods used

Element	Line number	Method
C	2	Combustion, infrared absorption, calibration with WC
	3, 4, 6, 7, 11, 15	Combustion, infrared absorption, calibration with CaCO ₃
	5, 14	Combustion, infrared absorption, calibration with Na ₂ CO ₃
	8	Combustion, coulometric titration, calibration with CaCO ₃
	9, 10, 13	Combustion, infrared absorption, calibration with BaCO ₃
	12	Combustion, infrared absorption, calibration with K ₂ CO ₃
S	1, 9	Combustion, infrared absorption, calibration with BaSO ₄
	2, 3, 8, 11, 13, 14	Combustion, infrared absorption, calibration with K ₂ SO ₄
	4	Combustion, UV absorption, calibration with K ₂ SO ₄
	5, 10	Combustion, infrared absorption, calibration with Cs ₂ SO ₄
	6	Combustion, infrared absorption, calibration with sulfanilic acid
	7	ICP-OES
N	12	Combustion, infrared absorption, calibration with Na ₂ SO ₄
	1, 2, 4, 6, 7, 9, 11	Thermal conductivity, decomposition in graphite crucible, calibration with KNO ₃
	3, 12	Thermal conductivity, decomposition in graphite crucible, calibration with Pb(NO ₃) ₂
	5, 8, 13	Thermal conductivity, decomposition in graphite crucible, gas calibration
	10	Thermal conductivity, decomposition in graphite crucible, calibration with Si ₃ N ₄
	14	MAS, indophenol blue, distillation
15	Acidimetric titration after distillation, visual end point	

Abbreviations:

ICP-OES Inductively Coupled Plasma - Optical Emission Spectrometry
 MAS Spectrophotometry

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 and CEN/TR 10350, both of which are available from the national standards body in your country. Further information and advice on this or other Certified Reference Materials or Reference Materials produced by the German CRM working group may be obtained from the address above.

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.

Weitere Informationen und Hinweise zu diesem oder anderen durch die Arbeitsgemeinschaft "Zertifiziertes Referenzmaterial Eisen und Stahl" hergestellten zertifizierten Referenzmaterialien oder Referenzmaterialien können unter der oben 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 et CEN/TR 10350. On peut se procurer ces deux documents auprès des organismes nationaux de normalisation.

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 Groupe de travail allemand pour les MRC sidérurgiques, peuvent être demandés en contactant l'adresse figurant plus haut dans 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 och CEN/TR 10350 som kan erhållas från den nationella standardiseringsorganisationen.

Ytterligare information och rådfrågan om detta eller andra certifierade referensmaterial eller referensmaterial, producerade av den tyska arbetsgruppen för CRM, kan erhållas från angiven adress på certifikatet enligt ovan.

The German Iron and Steel CRM Working Group

The Working Group is composed of
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin
Max-Planck-Institut für Eisenforschung GmbH (MPI), Düsseldorf
Steel institute VDEh, Düsseldorf



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