

ECSC - CECA - EGKS

EUROPEAN COAL AND STEEL COMMUNITY
COMMUNAUTÉ EUROPÉENNE DU CHARBON ET DE L'ACIER
EUROPÄISCHE GEMEINSCHAFT FÜR KOHLE UND STAHL

CERTIFIED REFERENCE MATERIAL
CERTIFICATE OF CHEMICAL ANALYSIS
EURO - CRM No. 776-1 FIREBRICK

LABORATORY MEANS (4 values)
mass content in % related to the dried (105°C) sample

Line No.	Si	Ti	Al	Fe	Ca	Mg	K	Na	Li	Cr	Ba	P	Zr
1	—	—	—	0.9695	0.1955	0.2700	—	0.3325	0.0079	0.0118	—	0.0228	0.0269
2	29.08	0.9400	15.31	0.9805	0.2065	0.2752	2.275	0.3395	0.0079	0.0123	0.0902	0.0235	0.0272
3	29.10	0.9425	15.38	0.9825	0.2075	0.2760	2.360	0.3396	0.0080	0.0135	0.0975	0.0236	0.0282
4	29.11	0.9450	15.39	0.9825	0.2100	0.2765	2.372	0.3495	0.0081	0.0137	0.0985	0.0239	0.0298
5	29.14	0.9562	15.40	0.9848	0.2108	0.2775	2.374	0.3555	0.0084	0.0140	0.1000	0.0245	0.0308
6	29.16	0.9587	15.41	0.9895	0.2146	0.2802	2.380	0.3555	0.0084	0.0142	0.1005	0.0245	0.0330
7	29.20	0.9610	15.42	0.9895	0.2180	0.2810	2.400	0.3568	0.0084	0.0150	0.1060	0.0246	0.0344
8	29.21	0.9622	15.42	0.9902	0.2192	0.2849	2.404	0.3575	0.0085	0.0151	0.1100	0.0248	
9	29.26	0.9662	15.45	0.9940	0.2200	0.2875	2.410	0.3600	0.0088	0.0154	0.1106	0.0262	
10	29.27	0.9708	15.45	0.9973	0.2202	0.2882	2.412	0.3602	0.0090	0.0158	0.1120	0.0270	
11	29.33	0.9724	15.46	0.9992	0.2216	0.2891	2.419	0.3611	0.0091	0.0158	0.1130	0.0279	
12	29.35	0.9725	15.47	1.0008	0.2220	0.2892	2.440	0.3625	0.0100	0.0158	0.1132	0.0282	
13	29.36	0.9742	15.52	1.0032	0.2225	0.2922	2.445	0.3625	0.0100	0.0158	0.1175	0.0300	
14	29.37	0.9760	15.53	1.0035	0.2236	0.2926	2.449	0.3650	0.0105	0.0158	0.1187	0.0305	
15	29.39	0.9770	15.58	1.0070	0.2238	0.2938	2.462	0.3652	—	0.0160	0.1228	0.0306	
16	29.47	0.9800	15.60	1.0106	0.2250	0.2940	2.468	0.3718	—	0.0163	0.1254	0.0314	
17	29.54	0.9830	15.61	1.0198	0.2320	0.2950	2.468	0.3750	—	0.0170	—	0.0328	
18	29.55	0.9835	15.65	1.0205	0.2400	0.2950	2.468	0.3784	—	0.0175	—	—	
19	29.58	0.9842	15.68	1.0225	0.2421	0.3006	2.475	0.3800	—	0.0178	—	—	
20	29.62	0.9878	15.74	1.0350	0.2500	0.3075	2.488	0.3821	—	0.0193	—	—	
21	29.64	0.9918	—	—	—	—	2.500	0.3940	—	—	—	—	
M_M	29.34	0.9692	15.50	0.9991	0.2212	0.2873	2.423	0.3621	0.0088	0.0154	0.1091	0.0269	0.030
s_M	0.18	0.0151	0.12	0.0166	0.0128	0.0095	0.054	0.0150	0.0008	0.0018	0.0101	0.0032	

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 any outlying values. Where a "—" appears in the table it indicates that an outlying value has been omitted.

NOTE: The loss of ignition at 1000°C has been found to be approximately 0.3% m/m.

CERTIFIED VALUES
mass content in %

	Si	Ti	Al	Fe	Ca	Mg	K	Na	Li	Cr	Ba	P
M_M	29.34	0.969	15.50	0.999	0.221	0.287	2.42	0.362	0.009	0.015	0.109	0.027
s_M	0.18	0.015	0.12	0.017	0.013	0.010	0.05	0.015	0.001	0.002	0.010	0.003

All values are 'total' element content

DESCRIPTION OF THE SAMPLE

This sample consists of material passing sieve of aperture size 125 μ m. It is supplied only in bottles containing 100g.



This reference material prepared and issued by:

BUREAU OF ANALYSED SAMPLES LIMITED

Newham Hall, Middlesbrough, England

MAY, 1983

On behalf of: The Commission of Co-ordination of the Nomenclature of
Metallurgical Products — Commission of European Communities.

ECRM 776-1

LABORATORY MEANS (4 values) EXPRESSED AS OXIDES mass content in % related to the dried (105°C) sample

Line No.	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	K ₂ O	Na ₂ O	Li ₂ O	Cr ₂ O ₃	BaO	P ₂ O ₅	ZrO ₂
1	—	—	—	1.386	0.2735	0.4477	—	0.4482	0.0170	0.0172	—	0.0522	0.0363
2	62.21	1.568	28.93	1.402	0.2889	0.4564	2.740	0.4576	0.0170	0.0180	0.1007	0.0538	0.0367
3	62.25	1.572	29.06	1.405	0.2903	0.4577	2.843	0.4578	0.0172	0.0197	0.1089	0.0541	0.0381
4	62.28	1.576	29.08	1.405	0.2938	0.4585	2.857	0.4711	0.0174	0.0200	0.1100	0.0548	0.0402
5	62.34	1.595	29.10	1.408	0.2949	0.4602	2.860	0.4792	0.0181	0.0205	0.1116	0.0561	0.0416
6	62.38	1.599	29.12	1.415	0.3003	0.4646	2.867	0.4792	0.0181	0.0208	0.1122	0.0561	0.0446
7	62.47	1.603	29.14	1.415	0.3050	0.4660	2.891	0.4810	0.0181	0.0219	0.1183	0.0564	0.0465
8	62.49	1.605	29.14	1.416	0.3067	0.4724	2.896	0.4819	0.0183	0.0221	0.1228	0.0568	
9	62.60	1.612	29.19	1.421	0.3078	0.4768	2.903	0.4853	0.0189	0.0225	0.1235	0.0600	
10	62.62	1.619	29.19	1.426	0.3081	0.4779	2.905	0.4855	0.0194	0.0231	0.1250	0.0619	
11	62.75	1.622	29.21	1.429	0.3100	0.4794	2.914	0.4868	0.0196	0.0231	0.1262	0.0639	
12	62.79	1.622	29.23	1.431	0.3106	0.4796	2.939	0.4886	0.0215	0.0231	0.1264	0.0646	
13	62.81	1.625	29.32	1.434	0.3113	0.4845	2.945	0.4886	0.0215	0.0231	0.1312	0.0687	
14	62.83	1.628	29.34	1.435	0.3129	0.4852	2.950	0.4920	0.0226	0.0231	0.1325	0.0699	
15	62.87	1.630	29.44	1.440	0.3131	0.4872	2.966	0.4923	—	0.0234	0.1371	0.0701	
16	63.05	1.635	29.48	1.445	0.3148	0.4875	2.973	0.5012		0.0238	0.1400	0.0709	
17	63.20	1.640	29.49	1.458	0.3246	0.4892	2.973	0.5055		0.0248		0.0752	
18	63.22	1.641	29.57	1.459	0.3358	0.4892	2.973	0.5101		0.0256			
19	63.28	1.642	29.63	1.462	0.3392	0.4985	2.981	0.5122		0.0260			
20	63.37	1.648	29.74	1.480	0.3498	0.5099	2.997	0.5151		0.0282			
21	63.41	1.654	—	—	—	—	3.012	0.5311					
M _M	62.76	1.617	29.28	1.429	0.3096	0.4764	2.919	0.4881	0.0189	0.0225	0.1218	0.0616	0.041
s _M	0.39	0.025	0.22	0.024	0.0180	0.0158	0.065	0.0202	0.0018	0.0026	0.0113	0.0073	

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 any outlying values. Where a "—" appears in the table it indicates that an outlying value has been omitted.

NOTE: The loss of ignition at 1000°C has been found to be approximately 0.3% m/m.

CERTIFIED VALUES mass content in %

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	K ₂ O	Na ₂ O	Li ₂ O	Cr ₂ O ₃	BaO	P ₂ O ₅
M _M	62.76	1.62	29.28	1.43	0.310	0.476	2.92	0.488	0.019	0.022	0.122	0.062
s _M	0.39	0.03	0.22	0.02	0.018	0.016	0.07	0.020	0.002	0.003	0.011	0.007

PARTICIPATING LABORATORIES

ARBED Division d'Esch Belval, Esch-sur-Alzette (Luxembourg)
 ARBED Saarstahl GmbH, Völklingen-Saar 1 (Germany)
 British Ceramic Research Association, Stoke-on-Trent (UK)
 British Steel Corporation, Corby Works (UK)
 Bundesanstalt für Materialprüfung (BAM), Berlin-Dahlem (Germany)
 Centro Sperimentale Metallurgico (CSM), Rome (Italy)
 Cockerill, Seraing (Belgium)
 English Clays, Lovering Pochin & Co. Ltd., St. Austell (UK)
 GR-Stein Refractories Ltd., Worksop (UK)
 Hoesch Hüttenwerke AG, Dortmund 1 (Germany)
 Hoogovens Group BV, IJmuiden (Holland)
 Institut de Recherches de la Sidérurgie Française (IRSID),
 Maizières-les-Metz (France)

Mannesmannröhren-Werke AG, Hüttenwerke Huckingen, Duisburg 25 (Germany)
 Ridsdale and Co. Ltd., Middlesbrough (UK)
 SACILOR, Amneville (France)
 Société Metallurgique Hainaut-Sambre, Couillet (Belgium)
 SOLLAC, Florange (France)
 SOLMER, Fos-sur-Mer (France)
 Stahlwerke Peine-Salzgitter AG, Salzgitter 41, (Germany)
 Stahlwerke Röchling-Burbach GmbH, Völklingen-Saar 1 (Germany)
 Thyssen AG, Duisburg 11 (Germany)
 USINOR, Dunkerque (France)

METHODS USED

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Element	Line Number	Methods
Si	2 - 3 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 17 - 20 - 21 4 - 13 12 - 14 - 16 - 18 - 19 15	Gravimetric, dehydration with perchloric acid Gravimetric, dehydration with hydrochloric acid XRF, fused bead technique, synthetic calibration Gravimetric, coagulation with polyethylene oxide
Ti	2 - 7 - 15 3 - 4 - 9 - 14 - 18 - 19 5 - 17 - 21 6 - 12 8 - 10 - 11 - 13 - 16 - 20	Photometric with dianthipyrylmethane Photometric with chromotropic acid Photometric with hydrogen peroxide FAAS XRF, fused bead technique, synthetic calibration
Al	2 3 - 10 - 11 - 20 4 - 7 - 8 - 12 - 14 - 16 5 6 - 17 - 19 9 - 13 - 15 - 18	Bromometric titration, precipitation with 8 hydroxyquinoline FAAS XRF, fused bead technique, synthetic calibration Gravimetric as aluminium phosphate Gravimetric, as oxide Complexometric titration
Fe	1 - 6 - 13 - 17 2 3 - 9 - 11 - 15 - 18 - 20 4 - 8 - 10 - 12 - 14 - 16 5 7 19	FAAS Photometric with thiocyanate Photometric with 1:10 phenanthroline XRF, fused bead technique, synthetic calibration Photometric with sulphosalicylic acid Photometric with α - α '-bipyridyl Photometric with thioglycolic acid
Ca	1 - 2 - 3 - 6 - 7 - 8 - 9 - 10 - 13 - 15 - 18 - 19 - 20 4 - 16 5 - 11 - 12 - 14 - 17	FAAS Titrimetric with permanganate, precipitation as oxalate XRF, fused bead technique, synthetic calibration
Mg	1 - 2 - 3 - 4 - 5 - 6 - 7 - 9 - 10 - 11 - 12 - 14 - 17 - 18 - 19 8 - 15 - 16 - 20 13	FAAS XRF, fused bead technique, synthetic calibration Gravimetric, precipitation as magnesium ammonium phosphate
K	2 - 3 - 7 - 8 - 10 - 11 - 15 - 16 - 17 - 19 4 - 6 - 9 - 13 - 18 - 21 5 - 12 - 14 20	FAAS FAES XRF, fused bead technique, synthetic calibration ICP AES
Na	1 - 2 - 6 - 7 - 8 - 9 - 10 - 12 - 13 - 14 - 16 - 19 3 - 4 - 5 - 15 - 17 - 20 - 21 11 18	FAAS FAES ICP AES XRF, fused bead technique, synthetic calibration
Li	1 - 2 - 3 - 4 - 5 - 9 - 13 6 - 7 - 8 - 10 - 11 - 12 - 14	FAES FAAS
Cr	1 - 2 - 3 - 13 - 17 4 - 18 - 20 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 15 - 16 - 19 14	Photometric with diphenylcarbazide XRF, fused bead technique, synthetic calibration FAAS ICP AES

METHODS USED

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Element	Line Number	Methods
Ba	2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 15	FAAS
	11	Gravimetric, precipitation as barium sulphate
	12 - 14 - 16	XRF, fused bead technique, synthetic calibration
	13	ICP AES
P	1 - 5	Photometric as phosphovanadomolybdate with extraction
	2 - 12 - 15	Photometric as phosphovanadomolybdate
	3 - 6 - 8	XRF, fused bead technique, synthetic calibration
	4 - 7 - 11 - 13 - 14 - 16 - 17	Photometric as molybdenum blue
	9 - 10	Photometric as molybdenum blue with extraction
Zr	1	Photometric with xylenol orange
	2 - 7	XRF, fused bead technique, synthetic calibration
	3 - 5	ICP AES
	4 - 6	Photometric with arsenazo III
Abbreviations:		
XRF : X-Ray fluorescence spectrometry		
FAAS : Flame atomic absorption spectrometry		
FAES : Flame atomic emission spectrometry		
ICP AES : Inductively coupled plasma atomic emission spectrometry		

FURTHER INFORMATION

For information regarding the preparation and certification of Euro-CRMs (Certified Reference Materials) and sources of supply please refer to ECSC Information Circular No. 1 available from the Institution responsible for standardization in your country. (In the UK this is the BSI, 2 Park Street, London. W1A 2BS.)

Pour tous renseignements sur les Euro-MRC (Matériaux de Référence Certifiés) se reporter à la Circulaire d'information No. 1 de la CECA, diffusée par les organismes nationaux de normalisation.

Wegen Erläuterungen über Euro-ZRM (Zertifiziertes Referenzmaterial) siehe Mitteilung Nr. 1 der EGKS, zu beziehen durch die nationalen Normenorganisationen.