

CERTIFIED REFERENCE MATERIAL CERTIFICATE OF CHEMICAL ANALYSIS

REFERENCE – CRM N° TL-1001
Steel 20NCD2 – DIN 1.6523 – AISI 8620

LABORATORY MEANS (4 values) – Mass content %

Line n°	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	N	Sn	Al
1	0,2050	0,2020	0,8312	0,0120	0,0205	0,4925	0,1860	0,5253	0,1850	0,0096	0,0083	0,0175
2	0,2075	0,2093	0,8349	0,0125	0,0205	0,5100	0,1955	0,5300	0,1862	0,0098	0,0085	0,0178
3	0,2099	0,2109	0,8525	0,0129	0,0223	0,5206	0,2005	0,5300	0,1870	0,0099	0,0092	0,0187
4	0,2100	0,2136	0,8641	0,0143	0,0230	0,5250	0,2019	0,5329	0,1876	0,0102	0,0092	0,0192
5	0,2100	0,2150	0,8643	0,0145	0,0231	0,5286	0,2023	0,5346	0,1903	0,0102	0,0097	0,0193
6	0,2103	0,2150	0,8675	0,0146	0,0233	0,5305	0,2060	0,5413	0,1906	0,0104		0,0195
7	0,2110	0,2178	0,8680	0,0148	0,0235	0,5325		0,5528	0,1943	0,0110		0,0199
8	0,2120	0,2288	0,8908	0,0149	0,0238	0,5437		0,5555	0,2005			0,0213
9	0,2125		0,9073	0,0164	0,0238	0,5530						
10	0,2128				0,0242	0,5538						
11	0,2140				0,0243							
12	0,2150				0,0249							
13					0,0263							
14					0,0272							
M_M	0,2108	0,2141	0,8645	0,0141	0,0236	0,5290	0,1987	0,5378	0,1902	0,0102	0,0090	0,0191
S_M	0,0027	0,0077	0,0242	0,0014	0,0018	0,0189	0,0071	0,0111	0,0051	0,0005	0,0006	0,0012
S_W	0,0028	0,0043	0,0059	0,0004	0,0010	0,0054	0,0021	0,0037	0,0025	0,0001	0,0002	0,0007

Line n°	As	Co	Ti
1	0,0039	0,0046	0,0120
2	0,0047	0,0069	0,0126
3	0,0049	0,0080	0,0132
4	0,0050	0,0085	0,0135
5	0,0069		0,0156
M_M	0,0051	0,0070	0,0134
S_M	0,0011	0,0017	0,0014
S_W	0,0003	0,0002	0,0002

M_M : Mean of intralaboratory means
S_M : Standard deviation of intralaboratory means
S_W : Intralaboratory standard deviation

The laboratory mean values have been examined statistically with the Cochran and Grubbs Test to eliminate outlying values.

Values given in italic are for information only and are not certified.

Additional values for information : B ~ 3,2 ppm, Ca ~ 22 ppm, Nb ~ 13 ppm, V ~ 30 ppm

CERTIFIED VALUES – Mass content in %

Element	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
M_M	0,2108	0,2141	0,8645	0,0141	0,0236	0,5290	0,1987	0,5378	0,1902
C (95%)	0,0018	0,0065	0,0186	0,0011	0,0011	0,0135	0,0075	0,0093	0,0043

Element	N	Sn	Al
M_M	0,0102	0,0090	0,0191
C (95%)	0,0004	0,0007	0,0010

$C(95\%)$: half-width confidence interval = $\frac{t \times s_M}{\sqrt{n}}$ 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 et 10.5.2.

METHODS USED

Element	Line n°	Methods
C	1,2,3,5,6,8,9,11,12 4,7,10	Combustion + Infrared (Comb/IR) Reduction fusion + Thermal conductivity (Fusion/Cond th)
Si	1,3,4,5,6,7,8 2	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
Mn	1,2,3,4,6,7,8,9 5	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
P	1,2,3,4,5,7,8,9 6	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
S	1,2,4,5,6,7,10,11,13,14 3,8,9 12	Combustion + Infrared (Comb/IR) Reduction fusion + Thermal conductivity (Fusion/Cond th) Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)
Cr	1,2,3,4,5,7,8,9,10 6	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
Mo	1,2,3,4,5,6	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)
Ni	1,2,3,5,6,7,8 4	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
Cu	1,2,3,4,5,6,8 7	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
N	2,3,4,5,6,7 1	Reduction fusion + Thermal conductivity (Fusion/Cond th) Combustion + Infrared (Comb/IR)
Sn	2,3,4,5 1	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Atomic Absorption Spectrometry (AAS)
Al	1,2,3,4,5,6,7,8	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)

As	1,2,3,5 4	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Atomic Absorption Spectrometry (AAS)
Co	1,2,3,4	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)
Ti	1,2,3,4,5	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)

DESCRIPTION OF THE SAMPLE

The steel TL-1001 is a disc of 20 mm high and 40 mm diameter.

INTENDED USE – STABILITY

The solid (disc) sample TL-1001 is intended for establishing and checking the calibration of instruments, such as Optical Emission Spectrometers and X-ray Spectrometers, for the analysis of samples of similar materials.

For best analytical results, use the same method for preparing the analytical surface on all reference materials as you use for production specimens.

The entire thickness of the disc can be used. It is recommended to avoid overheating the sample during surface preparation.

If the sample is stored and / or used in a normal environment [protected from heat, corrosive atmosphere, excessive humidity ...], the chemical composition of this sample does not undergo any evolution, whatever the duration of storage.

SAFETY NOTICE

A Material Safety Data Sheet (MSDS) is not required for this material. This material will not release or otherwise result in exposure to a hazardous chemical, under normal conditions of use.

TRACEABILITY

The traceability of CRM TL-1001 has been established in accordance with the ISO Guides 30-35 and the International vocabulary of basic and general terms in metrology.

The assigned values for each material are achieved by inter-laboratory characterization, 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

A2M INDUSTRIE	FR- 42490 FRAISSES
ACCIAIERIE BERTOLI SAFAU	FR- 57070 METZ
ACIERIE ET FONDERIE DE LA HAUTE SAMBRE	FR- 59145 BERLAIMONT
ACIERIES HACHETTE ET DRIOUT	FR- 52115 SAINT DIZIER Cedex
AMETEK	FR- 78990 ELANCOURT
APAVE SUDEUROPE SAS	FR- 69160 TASSIN LA DEMI LUNE
ARCELORMITTAL ATLANTIQUE ET LORRAINE DUNKERQUE	FR- 59760 GRANDE SYNTHÉ
ARCELORMITTAL MEDITERRANEE	FR- 13776 FOS-SUR-MER Cedex
ASCOVAL	FR- 59880 SAINT SAULVE
AUBERT ET DUVAL LES ANCIZES	FR- 63770 LES ANCIZES
BRAMMER STANDARD	US- 77069 HOUSTON
BUREAU VERITAS LABORATOIRES	FR- 95310 SAINT-OUEN L'AUMONE
CEA SACLAY	FR- 91191 GIF SUR YVETTE
CETIM NANTES	FR- 44308 NANTES Cedex 3
CNPE DE CHINON	FR- 37420 AVOINE
ENVIFORM a.s.	CZ- 73961 TRINEC
FRAMATOME-ETABLISSEMENT LE CREUSOT	FR- 71205 LE CREUSOT
INDUSTEEL BELGIUM	BE- 6030 CHARLEROI
INDUSTEEL FRANCE LE CREUSOT	FR- 71201 LE CREUSOT CEDEX
INDUSTEEL FRANCE RIVE DE GIER	FR- 42803 RIVE-DE-GIER CEDEX
INSTITUTE FOR CERTIFIED REFERENCE MATERIALS (ICRM)	RU- 620057 EKATERINBURG
INSTYTUT METALURGII ZELAZA (IMZ)	PL - 44100 GLIWICE
LABORATOIRE METALLURGIQUE DE L'EST	FR- 54340 POMPEY
LABORATOIRES POURQUERY	FR- 69354 LYON CEDEX 07
LUXCONTROL	LU- 4004 ESCH SUR ALZETTE
METALCONTROL	FR- 77100 MEAUX
TECHLAB	FR- 57072 METZ CEDEX 3
VALLOUREC RESEARCH CENTER	FR- 59620 AULNOYE-AYMERIES

REFERENCES

- ISO 5725-2 : Accuracy (trueness and precision) of measurement methods and results – Part 2 : Basic method for the determination of repeatability and reproducibility of a standard measurement method
- ISO GUIDE 35 : Reference Materials – General and statistical principles for certification
- E826-85 : Standard practice for testing homogeneity of Materials for the Development of Reference Materials

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