CERTIFIED REFERENCE MATERIAL
CERTIFICATE OF CHEMICAL ANALYSIS

REFERENCE – CRM N° **TL-2101**
Steel Pins

LABORATORY MEANS (4 values) – Mass content in %

Line n°	C	O	N	H	S
1	0,0219	0,0027	0,0930	0,00045	*0,0002*
2	0,0224	0,0028	0,0934	0,00054	*0,0003*
3	0,0230	0,0032	0,0934	0,00057	*0,0004*
4	0,0230	0,0032	0,0935	0,00059	*0,0009*
5	0,0233	0,0033	0,0944	0,00061	*0,0009*
6	0,0233	0,0035	0,0957	0,00061	*0,0010*
7	0,0233	0,0036	0,0960	0,00061	*0,0010*
8	0,0234	0,0036	0,0960	0,00064	*0,0011*
9	0,0235	0,0036	0,0964	0,00067	*0,0011*
10	0,0238	0,0037	0,0966	0,00068	*0,0012*
11	0,0240	0,0038	0,0976		*0,0014*
12	0,0240	0,0039	0,0980		*0,0014*
13	0,0243	0,0040	0,0993		*0,0015*
14	0,0247	0,0046	0,1001		*0,0019*
15	0,0249		0,1019		
16	0,0249				
17	0,0256				
18	0,0258				
M_M	0,0238	0,0035	0,0964	0,00060	*0,0010*
s_M	0,0011	0,0005	0,0026	0,00007	*0,0005*
s_W	0,0005	0,0001	0,0008	0,00002	*0,0001*

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 with the Cochran and Grubbs Test to eliminate outlying values.
Values given in italic are for information only and are not certified.

CERTIFIED VALUES – Mass content in %

Element	C	O	N	H
M_M	0,0238	0,0035	0,0964	0,00060
C (95%)	0,0005	0,0003	0,0015	0,00005

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	1,2,3,4,5,6,7,8,9,10,11,12,13,14,16,15,17,18	Combustion + Infrared (Comb/IR)
O	1,2,3,6,7,8,9,10,11,12,14 4,5,13	Reduction fusion + Infrared (Fusion/IR) Reduction fusion + Thermal conductivity (Fusion/Cond th)
N	2,3,4,5,7,8,9,10,11,12,13,14,15 1,6	Reduction fusion + Thermal conductivity (Fusion/Cond th) Reduction fusion + Infrared (Fusion/IR)
H	1,4,5,6,7,8,9,10 2,3	Reduction fusion + Thermal conductivity (Fusion/Cond th) Reduction fusion + Infrared (Fusion/IR)
S	*1,2,3,4,5,6,7,8,9,10,11,12,13,14*	*Combustion + Infrared (Comb/IR)*

DESCRIPTION OF THE SAMPLE

The sample TL-2101 is a steel pin of 3 mm diameter, 10 mm length and an average sample mass of 0,545 ± 0,002g per pin.
This material is packaged in a bottle of 50 pins.

INTENDED USE

The intended use of this material is for the calibration and validation of inert gas fusion (Oxygen, Nitrogen and Hydrogen) and combustion (Carbon, Sulfur).

PREPARATION

The sample TL-2101 was prepared and packaged for immediate use by respecting the handling conditions of the pins before analysis.

STORAGE

This reference material should be stored in a tightly closed bottle in a dry and cool place. When the bottle is opened for analysis, it should be stoppered immediately after use.

TRACEABILITY

The traceability of CRM TL-2101 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 substances or stoichiometric compounds.

PARTICIPATING LABORATORIES

ACCIAIERIE BERTOLI SAFAU	FR- 57070 METZ
APERAM IMPHY	FR- 58160 IMPHY
APERAM ISBERGUES	FR- 62330 ISBERGUES
ARCELORMITTAL GANDRANGE	FR- 57283 MAIZIERES LES METZ
ARCELORMITTAL INDUSTEEL BELGIUM	BE- 6030 CHARLEROI
ARCELORMITTAL MEDITERRANEE	FR- 13776 FOS-SUR-MER Cedex
ARCELORMITTAL RESEARCH SA	FR- 57280 MAIZIERES LES METZ
ASCOMETAL FOS SUR MER	FR- 13771 FOS SUR MER Cedex
BRAMMER STANDARD	US- 77069 HOUSTON
BUREAU VERITAS LABORATOIRES	FR- 95310 SAINT OUEN L'AUMONE
CETIM NANTES	FR- 44000 NANTES
EAG LABORATORIES	FR- 31100 TOULOUSE
EDF LES RENARDIERES	FR- 77818 MORET-SUR-LOING Cedex
ENVIFORM a.s.	CZ- 73961 TRINEC
FILAB	FR- 21000 DIJON
FRAMATOME-CENTRE TECHNIQUE LE CREUSOT	FR- 71205 LE CREUSOT
FRAMATOME-ETABLISSEMENT LE CREUSOT	FR- 71203 LE CREUSOT
METAFENSCH	FR- 57270 UCKANGE
SIEC BADAWCZA LUKASIEWICZ-INSTYTUT METALURGII ZELAZA	PL- 44100 GLIWICE
TECHLAB	FR- 57070 SAINT JULIEN LES METZ
VALINOX NUCLEAIRE	FR- 21500 MONTBARD
VALLOUREC RESEARCH CENTER	FR- 59620 AULNOYE-AYMERIES

REFERENCES

- ISO 17034:2016 : General requirements for the competence of reference material producers
- ISO/GUIDE 35:2017 : Reference materials – Guidance for characterization and assessment of homogeneity and stability
- ISO 5725-2 : 2019 : 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
- ASTM E1019-11 : Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

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