

CERTIFICATE OF ANALYSIS

IMZ 122

REFERENCE MATERIAL LOW ALLOY STEEL

Analysis listed as percent by weight [% m/m]

| | | | |
|----|-------|----|---------|
| C | 0.27 | Cu | 0.25 |
| Mn | 1.33 | As | 0.007 |
| Si | 0.43 | N | 0.0110 |
| P | 0.073 | Sb | 0.019 |
| S | 0.21 | Sn | 0.12 |
| Cr | 0.19 | Al | (0.027) |
| Ni | 0.25 | Pb | (0.020) |

Values in brackets are informative

Certificate Number: IMZ122-03072024

Certificate revision history on page 4

| Analysis | C | Mn | Si | P | S | Cr | Ni |
|-----------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|
| 1 | 0.260 | 1.310 | 0.410 | 0.0710 | 0.193 | 0.177 | 0.243 |
| 2 | 0.261 | 1.320 | 0.423 | 0.0713 | 0.201 | 0.180 | 0.247 |
| 3 | 0.262 | 1.320 | 0.423 | 0.0720 | 0.203 | 0.183 | 0.247 |
| 4 | 0.264 | 1.330 | 0.430 | 0.0740 | 0.205 | 0.183 | 0.247 |
| 5 | 0.267 | 1.330 | 0.430 | 0.0750 | 0.207 | 0.183 | 0.250 |
| 6 | 0.267 | 1.333 | 0.433 | 0.0750 | 0.207 | 0.190 | 0.251 |
| 7 | 0.270 | 1.339 | 0.437 | 0.0750 | 0.210 | 0.194 | 0.253 |
| 8 | 0.270 | 1.350 | | | 0.215 | 0.196 | 0.257 |
| 9 | 0.270 | | | | 0.217 | 0.200 | 0.263 |
| 10 | 0.273 | | | | | 0.204 | |
| Average | 0.266 | 1.329 | 0.427 | 0.0733 | 0.206 | 0.189 | 0.251 |
| SD | 0.004 | 0.012 | 0.009 | 0.0019 | 0.007 | 0.009 | 0.006 |
| Certified | 0.27 | 1.33 | 0.43 | 0.073 | 0.21 | 0.19 | 0.25 |
| C(95%) | 0.003 | 0.010 | 0.006 | 0.0018 | 0.006 | 0.006 | 0.005 |

| Analysis | Cu | Sn | Pb* | As | Sb | Al* | N |
|-----------|-------------|-------------|--------|--------------|--------------|--------|---------------|
| 1 | 0.243 | 0.112 | 0.0167 | 0.0070 | 0.0177 | 0.0220 | 0.0098 |
| 2 | 0.248 | 0.112 | 0.0170 | 0.0070 | 0.0183 | 0.0225 | 0.0107 |
| 3 | 0.250 | 0.119 | 0.0180 | 0.0071 | 0.0183 | 0.0247 | 0.0110 |
| 4 | 0.250 | 0.120 | 0.0197 | 0.0073 | 0.0183 | 0.0297 | 0.0110 |
| 5 | 0.250 | 0.121 | 0.0200 | | 0.0192 | 0.0297 | 0.0112 |
| 6 | 0.251 | 0.121 | 0.0210 | | 0.0201 | 0.0297 | 0.0114 |
| 7 | 0.253 | | 0.0247 | | 0.0203 | 0.0300 | 0.0118 |
| 8 | 0.257 | | | | | 0.0320 | |
| 9 | 0.257 | | | | | | |
| Average | 0.251 | 0.117 | 0.0196 | 0.00703 | 0.0189 | 0.0275 | 0.01099 |
| SD | 0.004 | 0.004 | 0.0028 | 0.00006 | 0.0010 | 0.0039 | 0.00063 |
| Certified | 0.25 | 0.12 | | 0.007 | 0.019 | | 0.0110 |
| C(95%) | 0.003 | 0.005 | | 0.0001 | 0.0010 | | 0.00061 |

* - informative values

$C(95\%) = (t \cdot SD) / \sqrt{n-1}$ - The half-width confidence interval, calculated for the 95 % confidence level, where t is the appropriate Student's t value, SD is the interlaboratory standard deviation and n is the number of acceptable mean values. For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.

Certification Process: Both preparation of this Reference Material and certification process were prepared according to requirements of ISO Guide 31, ISO Guide 34 and ISO Guide 35. This Reference Material is in agreement with ISO Guide 30.

Chemical Analysis: Chemical analyses were carried out on chips prepared by milling of the certified portion of the bars and also for some solid samples. Single values in the above table are the means obtained by individual laboratories. The following methods were used for analysis:

- **carbon and sulphur** - high frequency infra-red absorption (HFIR);
- **manganese** - flame AAS, ICP-AES, photometric with potassium periodate, titrimetric arsenite-nitrite;
- **silicon** - ICP-AES, photometric as silicon-molybdenum blue, gravimetric;
- **phosphorus** - photometric as molybdenum blue, photometric as phosphovanado-molybdate, titrimetric, ICP-AES;
- **chromium** - flame AAS, ICP-AES, photometric with diphenylcarbazide, potentiometric, titrimetric;
- **nickel** - flame AAS, ICP-AES, photometric with dimethylglyoxime, potentiometric;
- **copper** - flame AAS, ICP-AES, photometric with diethyldithiocarbamate;
- **aluminium** - flame AAS, ICP-AES, photometric with aluminon, photometric with eriochromocyanin R;
- **arsenic, antimony** - photometric, GF AAS;
- **lead** - flame AAS, ICP-AES;
- **tin** – GF AAS, ICP-AES;
- **nitrogen** – high temperature extraction.

The laboratories participating in the testing of this Reference Material were:

Huta Baildon, Katowice, Poland
 Huta Częstochowa, Częstochowa, Poland
 Huta Katowice S.A., Dąbrowa Górnicza, Poland
 Huta Łabędy, Gliwice, Poland
 Huta Ostrowiec S.A., Ostrowiec Świętokrzyski, Poland
 Huta im. Tadeusza Sendzimira, Kraków, Poland
 Huta Stalowa Wola - Zakład Hutniczy Sp. z o.o., Stalowa Wola, Poland
 Instytut Metalurgii Żelaza, Gliwice, Poland
 Hilger Analytical Ltd, Margate, Great Britain
 Nova hut Ostrava s.p., Ostrava, Czech Republic
 Ströhlein West Gmbh & Co., Kaarst, Germany
 Třinecké Železárny, a.s., Třinec, Czech Republic
 VSZ Labortest, spol. s r.o., Košice, Slovakia.

Homogeneity: The homogeneity of this Reference Material was evaluated with the use of statistic parameters obtained during interlaboratory tests in 1996 and found acceptable. Optical emission spectrometry with spark excitation method was used.

Traceability: This Reference Material was tested with the use of optical emission spectrometry with spark excitation and was found compatible to the following CRMs: SS 431-435, SS 401-410, SS 50-60, SS 456-460, SS 421-424, CKD 162A-171A.

Production of melt: This material was produced by Huta Baildon, Katowice. The melt was made in an open induction furnace and then ESR remelted.

Available form: Discs: 40 mm in diameter and 40 mm thick; chips: bottles 100g.

Intended use: This Reference Material is intended for use in optical emission and X-ray spectrometric methods (bulks sample) and also in classical wet methods, UV-Vis spectrometry, AAS, ICP-AES, C,S- and N- analyzers and other wet methods (chips). Caution: In optical emission spectrometry with spark excitation the central part of the surface of discs (approximately 5 mm) should be avoided because of possible segregation of the material.

Validity of certification: The certification of IMZ 122 is valid indefinitely provided this Reference Material is stored in dry place and in environment free from chemical or other aggressive vapours. Periodic recertification is not required. The certification is nullified if this Reference Material is damaged, contaminated or otherwise modified. Chips: if the contents of the bottle becomes changed (for example oxidized) or contaminated, the whole contents of bottle should be discarded.

Safety: This Reference Material and packing does not contain substances which can directly influence health.

Storage: This Reference Material should be stored in dry place and in environment free from chemical or other aggressive vapours.

Inquiries regarding this Reference Material should be directed to:
rm@git.lukasiewicz.gov.pl

Approved by
Director of the Institute

Prof. Dr. Hab. Eng. Adam Zieliński

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Certificate revision history:

Certificate revision history:

03 July 2024 (editorial changes)

28 January 2021 (change of information regarding validity of certification, editorial changes);

January 2003 , August 2002 (editorial changes);

August 1997 (Original certificate date).