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GIT

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# CERTIFICATE OF ANALYSIS

# IMZ 303

## CERTIFIED REFERENCE MATERIAL
## STAINLESS STEEL

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

| | Certified value | Expanded uncertainty | | Certified value | Expanded uncertainty |
|---|---|---|---|---|---|
| C | 0.105 | ± 0.002 | Co | 0.017 | ± 0.002 |
| Si | 0.74 | ± 0.01 | Cu | 0.018 | ± 0.002 |
| Mn | 1.23 | ± 0.04 | V | 0.037 | ± 0.004 |
| P | 0.038 | ± 0.001 | Ti | 0.60 | ± 0.01 |
| S | 0.011 | ± 0.001 | N | 0.0113 | ± 0.0008 |
| Cr | 19.56 | ± 0.06 | Al | 0.100 | ± 0.002 |
| Ni | 8.26 | ± 0.04 | | | |

the expanded uncertainty bases on statistical evaluation of the contributions the interlaboratory certification analysis and the material homogeneity

Certificate Number: IMZ 303-181124
Certificate revision history on page 4

| Analysis | C | * | Si | * | Mn | * | P | * | S | * | Cr | * | Ni | * | Mo** | * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,097 | 5 | 0,71 | 17 | 1,191 | 7 | 0,035 | 17 | 0,008 | 17 | 19,36 | 7 | 8,16 | 7 | 0,00446 | 7 |
| 2 | 0,099 | 2 | 0,72 | 7 | 1,20 | 5 | 0,036 | 1 | 0,009 | 5 | 19,43 | 7 | 8,18 | 5 | 0,005 | 17 |
| 3 | 0,100 | 2 | 0,7243 | 8 | 1,20 | 5 | 0,036 | 5 | 0,010 | 5 | 19,48 | 10 | 8,20 | 5 | 0,006 | 5 |
| 4 | 0,103 | 2 | 0,725 | 5 | 1,20549 | 7 | 0,036 | 5 | 0,010 | 1 | 19,4961 | 7 | 8,20 | 1 | 0,00680 | 7 |
| 5 | 0,104 | 5 | 0,72996 | 7 | 1,21 | 1 | 0,037 | 5 | 0,0106 | 2 | 19,497 | 10 | 8,21 | 7 | 0,007 | 5 |
| 6 | 0,105 | 5 | 0,73 | 5 | 1,21 | 14 | 0,037 | 5 | 0,0107 | 2 | 19,50 | 17 | 8,22 | 5 | 0,01 | 1 |
| 7 | 0,105 | 2 | 0,74 | 1 | 1,21 | 5 | 0,0375 | 6 | 0,011 | 1 | 19,52 | 1 | 8,23454 | 7 | 0,008 | 5 |
| 8 | 0,105 | 2 | 0,74 | 5 | 1,216 | 1 | 0,0376 | 5 | 0,011 | 5 | 19,529 | 10 | 8,24 | 1 | 0,009 | 7 |
| 9 | 0,105 | 2 | 0,748 | 5 | 1,22 | 17 | 0,0380 | 1 | 0,0117 | 2 | 19,54 | 17 | 8,26 | 5 | 0,0093 | 7 |
| 10 | 0,1058 | 2 | 0,75 | 5 | 1,22 | 7 | 0,038 | 5 | 0,01181 | 2 | 19,54 | 5 | 8,270 | 12 | 0,013 | 5 |
| 11 | 0,107 | 5 | 0,75 | 5 | 1,23 | 5 | 0,0382 | 7 | 0,0119 | 2 | 19,55 | 5 | 8,2713 | 10 | 0,014 | 1 |
| 12 | 0,10701 | 2 | 0,75 | 1 | 1,23 | 5 | 0,03859 | 12 | 0,012 | 2 | 19,60 | 5 | 8,28 | 17 | 0,018 | 7 |
| 13 | 0,109 | 2 | 0,75 | 8 | 1,239 | 5 | 0,039 | 5 | 0,012 | 5 | 19,6 | 5 | 8,28 | 5 | 0,024 | 5 |
| 14 | 0,11 | 2 | 0,75 | 5 | 1,245 | 5 | 0,039 | 7 | 0,0122 | 2 | 19,61 | 5 | 8,28 | 5 | 0,026 | 5 |
| 15 | | | 0,768 | 7 | 1,255 | 7 | 0,03943 | 7 | 0,0122 | 2 | 19,61 | 5 | 8,29 | 17 | | |
| 16 | | | 0,815 | 7 | 1,2584 | 12 | 0,03953 | 7 | 0,01277 | 7 | 19,65 | 10 | 8,30 | 5 | | |
| 17 | | | | | 1,26 | 17 | 0,040 | 7 | 0,013 | 5 | 19,691 | 7 | 8,31 | 7 | | |
| 18 | | | | | 1,2651 | 14 | | | 0,01308 | 2 | 19,7 | 5 | 8,333 | 7 | | |
| 19 | | | | | 1,27 | 7 | | | | | 19,7 | 1 | 8,37 | 12 | | |
| 20 | | | | | | | | | | | 20,08 | 7 | | | | |
| Average[1] | 0,1048 | | 0,7415 | | 1,2276 | | 0,03780 | | 0,0114 | | 19,5645 | | 8,2578 | | 0,0096 | |
| SD[2] | 0,0029 | | 0,0147 | | 0,0237 | | 0,00136 | | 0,0011 | | 0,0823 | | 0,0469 | | 0,0040 | |
| u characterization[3] | 0,00097 | | 0,00461 | | 0,0068 | | 0,00041 | | 0,00032 | | 0,02307 | | 0,01347 | | 0,00134 | |
| u homogeneity[4] | 0,0002 | | 0,0009 | | 0,020 | | 0,00007 | | 0,00007 | | 0,017 | | 0,017 | | 0,00005 | |
| Certified value[5] | **0,105** | | **0,74** | | **1,23** | | **0,038** | | **0,011** | | **19,56** | | **8,26** | | | |
| Expanded uncertainty[6] | **0,002** | | **0,01** | | **0,04** | | **0,001** | | **0,001** | | **0,06** | | **0,04** | | | |

| Analysis | Co | * | V | * | W** | * | Ti | * | Cu | * | Al | * | Nb** | * | N | * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,0116 | 7 | 0,030 | 5 | 0,00452 | 7 | 0,578 | 7 | 0,010 | 5 | 0,0964 | 6 | 0,00243 | 6 | 0,01053 | 3 |
| 2 | 0,01368 | 7 | 0,030 | 1 | 0,00573 | 6 | 0,59 | 7 | 0,012 | 5 | 0,099 | 7 | 0,0034 | 7 | 0,01078 | 10 |
| 3 | 0,015 | 5 | 0,030 | 17 | 0,008 | 5 | 0,591 | 5 | 0,0159 | 6 | 0,099 | 7 | 0,00359 | 7 | 0,0110 | 5 |
| 4 | 0,015 | 5 | 0,033 | 7 | 0,010 | 5 | 0,60 | 5 | 0,016 | 14 | 0,0993 | 5 | 0,004 | 1 | 0,011 | 5 |
| 5 | 0,016 | 1 | 0,033 | 5 | 0,012 | 1 | 0,60 | 1 | 0,017 | 5 | 0,09999 | 7 | 0,010 | 5 | 0,011 | 5 |
| 6 | 0,017 | 5 | 0,0359 | 6 | 0,014 | 7 | 0,600 | 5 | 0,017 | 7 | 0,10 | 5 | 0,012 | 5 | 0,0111 | 3 |
| 7 | 0,017 | 7 | 0,037 | 7 | 0,018 | 1 | 0,60 | 5 | 0,018 | 7 | 0,10 | 17 | < 0,001 | 5 | 0,0114 | 3 |
| 8 | 0,017 | 5 | 0,03776 | 7 | 0,020 | 5 | 0,601 | 7 | 0,018 | 5 | 0,100 | 5 | < 0,023 | 5 | 0,0114 | 3 |
| 9 | 0,0178 | 6 | 0,038 | 1 | 0,020 | 5 | 0,60172 | 7 | 0,018 | 17 | 0,102 | 5 | | | 0,0117 | 3 |
| 10 | 0,019 | 7 | 0,040 | 5 | 0,022 | 5 | 0,61 | 1 | 0,018 | 5 | 0,102 | 5 | | | 0,012 | 5 |
| 11 | 0,0213 | 5 | 0,042 | 7 | < 0,01 | 5 | 0,61 | 5 | 0,019 | 1 | 0,105 | 5 | | | 0,0124 | 3 |
| 12 | 0,023 | 5 | 0,043 | 5 | | | 0,61 | 17 | 0,019 | 1 | | | | | 0,0125 | 3 |
| 13 | | | 0,044 | 5 | | | 0,612 | 5 | 0,020 | 7 | | | | | | |
| 14 | | | 0,05 | 5 | | | 0,612 | 5 | 0,021 | 5 | | | | | | |
| 15 | | | | | | | 0,618 | 7 | 0,02220 | 7 | | | | | | |
| 16 | | | | | | | 0,62 | 17 | 0,0247 | 5 | | | | | | |
| Average[1] | 0,0169 | | 0,0372 | | 0,0134 | | 0,6040 | | 0,0181 | | 0,1001 | | 0,0042 | | 0,0113 | |
| SD[2] | 0,0027 | | 0,0055 | | 0,0064 | | 0,0097 | | 0,0022 | | 0,0014 | | 0,0013 | | 0,0005 | |
| u characterization[3] | 0,00099 | | 0,00183 | | 0,0025 | | 0,00303 | | 0,00068 | | 0,00054 | | 0,00069 | | 0,00019 | |
| u homogeneity[4] | | | 0,00007 | | 0,0003 | | 0,0042 | | 0,00037 | | 0,0011 | | 0,0002 | | | |
| Certified value[5] | **0,017** | | **0,037** | | | | **0,60** | | **0,018** | | **0,100** | | | | **0,0113** | |
| Expanded uncertainty[6] | **0,002** | | **0,004** | | | | **0,01** | | **0,002** | | **0,002** | | | | **0,0008** | |

| Analysis | Sn** | * | As** | * | Sb** | * | Pb** | * | B** | * | Zn** | * | Zr** | * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,00082 | 7 | 0,00229 | 7 | 0,00027 | 7 | 0,001 | 5 | 0,0002 | 5 | 0,00089 | 7 | 0,001 | 1 |
| 2 | 0,002 | 5 | 0,003 | 1 | 0,0025 | 5 | 0,00173 | 7 | 0,0003 | 5 | 0,0021 | 14 | 0,00156 | 6 |
| 3 | 0,002 | 5 | 0,0048 | 7 | < 0,001 | 5 | < 0,001 | 5 | 0,00076 | 7 | < 0,001 | 5 | 0,00459 | 7 |
| 4 | 0,0022 | 5 | 0,005 | 5 | | | | | < 0,0001 | 5 | | | < 0,001 | 5 |
| 5 | < 0,002 | 5 | 0,008 | 5 | | | | | < 0,0005 | 5 | | | < 0,006 | 5 |
| 6 | | | < 0,001 | 5 | | | | | < 0,001 | 5 | | | | |
| Average[1] | 0,0020 | | 0,0046 | | | | | | 0,0003 | | | | | |
| SD[2] | 0,0002 | | 0,0022 | | | | | | 0,0002 | | | | | |
| u characterization[3] | 0,00011 | | 0,00124 | | | | | | | | | | | |
| u homogeneity[4] | | | 0,0005 | | | | | | | | | | | |
| Certified value[5] | | | | | | | | | | | | | | |
| Expanded uncertainty[6] | | | | | | | | | | | | | | |

* - analytical method used
** informative value

All values are based on recommendations of the ISO GUIDE 35:2017(E) standard:

1. **Average** is calculated according to Algorithm A (Guide clause A.2.3.4: Robust statistics;
2. **Standard deviation** is calculated according to Algorithm A (Guide clause A.2.3.4: Robust statistics);
3. **Uncertainty of material characterization** is based on the data obtained from the analysis performer by Network of competent labs (Guide clause 9.5) and calculated according to Guide clause B.5.2;
4. **Uncertainty associated with homogeneity** of material is calculated in agreement with Guide clause 7.11 (Uncertainty evaluation from homogeneity studies);

5. **Certified value** is the average value rounded to one or two significant digits of expanded uncertainty;
6. **Expanded uncertainty** is an geometric average of u characterization and u homogeneity multiplied by coverage factor k = 2.

**Certification Process:** Both preparation of this Reference Material and certification process were prepared according to requirements PN-EN 17034 and ISO GUIDE 35:2017(E).

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

1 – wavelength dispersive x-ray fluorescence spectrometry,
2 – combustion and infra-red detection,
3 – high temperature extraction and thermo conductivity detection,
5 – spark atomic emission spectrometry,
6 – inductive coupled plasma mass spectrometry,
7 – inductive coupled plasma atomic emission spectrometry,
8 – gravimetry,
9 – potentiometric titration,
12 – spectrophotometry,
13 – coulometry,
14 – flame atomic emission spectrometry,
17 – energy dispersive x-ray fluorescence spectrometry.

**The laboratories participating in certification analysis:**

- ArcelorMittal, Dąbrowa Górnicza, Poland, PCA 17025 – AB 1449,
- Cognor S.A.Oddział HSJ w Stalowej Woli, Polands, Zakładowe Laboratorium Badawczo-Doświadczalne; UDT LB-032/22-16,
- Dunaferr Labor Nonprofit Ltd, DunaújvárosEnvironmental and Chemical Analytical Material Testing Department and Spectrometric Material Testing Department, Hungary, Accreditation ISO/IEC 17025; NAH-2-0330/2016,
- Enviform a.s., Třinec, The Czech Republic; Testing Laboratory Nr 1371; Accreditation Certificate No, 219/2016 by the Czech Accreditation Institute; ČSN EN ISO/IEC 17025:2005,
- Institute for Certified Reference Materials, Jekatierinburg, Russia, Accreditation RU.0001.510008,
- Lithea, Ltd. Brno, The Czech Republic,
- OnderzoeksCentrum voor de Aanwending van Staal, Zelzate, Belgium,
- PJSC “Electrometallurgical works “Dneprospetsstal”, Zaporozhye, Ukraine,
- Sieć Badawcza Łukasiewicz - Instytut Metalurgii Żelaza, Poland, Gliwice, PCA 17025 - AB554,
- Vitkovice Testing Center, Ostrava, The Czech Republic, Testing Laboratory Nr 1036; Accreditation Certificate No. 531/2018 by the Czech Accreditation Institute; ČSN EN ISO/IEC 17025:2005.

**Homogeneity:** The homogeneity of this Reference Material was evaluated in accordance with guidelines of ISO GUIDE 35:2017(E). Optical emission spectrometry with spark excitation method was used.

**Traceability:** This Reference Material was found traceable to the following CRMs: 18C2a, 28C2/2, B2752, B2764, BCS-CRM No.111, BCS-CRM No.113, BCS SS 304a, BS85D, BCS SS 331, BCS SS 451, BS 8620E, BS 160A, BS2931A, BS 1048, BS 56H, BS 55G, BS 61G, BCS SS 463/1, BS 465/1, C26/5, C31/4, C32/4, C38/6, C39/4, C61, ECRM 077-3, Euro 187-1, IMZ117, IMZ1.5/3, IMZ1.77, IMZ1.84, IMZ1.10/1, IMZ 1.9/2, IMZ111, IMZ1.5/2, IMZ132, IMZ152, IMZ153A, IMZ154, IMZ157, IMZ158, IMZ300, IMZ504, MBH 321,NIST 362, NIST 363, NIST1154, NIST 1763, NIST2165, NIST 2167, UNL1/2, UNL10/3, UNL18, TL1001,pure chemicals.

**Production of melt:** This material was manufactured by Baildon steel plant, Katowice, Poland.

**Available form:** Discs approx. 40 mm in diameter and 37 mm high.

**Intended use:** This Reference Material is intended for use in spark atomic emission and X-ray spectrometric methods.
Note: In optical emission spectrometry with spark excitation it is recommended to avoid using the central part of the surface (diameter approx. 5 mm) due to possible segregation of material.

**Validity of certification:** The certification of IMZ 303 is valid indefinitely within the uncertainty specified 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.

**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

Certificate issue date: 18 November 2024

Certificate revision history:
18 November 2024 (editorial changes)
20 December 2021 (Original certificate date)