

Brammer Standard Company, Inc.
Certificate of Analysis

BS 200A

Certified Reference Material for Nickel 200 - UNS Number N02200¹

| | Certified Value ² | Estimate of Uncertainty ³ | | Certified Value ² | Estimate of Uncertainty ³ | |
|-----------|-------------------------------------|--------------------------------------|-----------|------------------------------|--------------------------------------|--|
| | Certified values⁴ | | | | | |
| Al | 0.0281 | 0.0007 | O | 0.0013 | 0.0005 | |
| As | 0.0015 | 0.0007 | P | 0.0007 | 0.0001 | |
| B | 0.0044 | 0.0003 | S | 0.0037 | 0.0002 | |
| C | 0.078 | 0.001 | Si | 0.0051 | 0.0003 | |
| Ca | 0.0003 | 0.0001 | Ti | 0.0427 | 0.0008 | |
| Co | 0.0564 | 0.0009 | V | 0.0006 | 0.0001 | |
| Cr | 0.0006 | 0.0002 | W | 0.0005 | 0.0001 | |
| Cu | 0.0038 | 0.0002 | | | | |
| Fe | 0.074 | 0.001 | | | | |
| Mg | 0.0131 | 0.0004 | | | | |
| Mn | 0.151 | 0.002 | | | | |
| Mo | 0.0004 | 0.0001 | | | | |
| N | 0.0004 | 0.0001 | | | | |
| Nb | 0.0004 | 0.0001 | | | | |
| Ni | 99.54 | 0.08 | | | | |

Informational values^{4,5}

Pb (0.00005) Sb (0.00002) Sn (0.0001) Ta (0.0003) Zr (0.0004)

¹ This certificate is a revision. For more information on the nature and extent of the revision, see the revision statement on page 6.

² For each element, the certified value listed is the present best estimate of the true value based on the mean of the weighted results of an interlaboratory testing program. See page 3 for more information on its calculation.

³ For each element, the uncertainty listed is based on a statistical evaluation of the contributions of homogeneity and the interlaboratory testing program. See page 3 for more information on its calculation.

⁴ Values are given in weight percent.

⁵ Values in parentheses are not certified and are provided for information only.

Trace element information values for Ag, Au, Ba, Be, Bi, Br, Cd, Ce, Cl, Cs, Dy, Er, Eu, F, Ga, Gd, Ge, Hf, Hg, Ho, I, In, Ir, K, La, Li, Lu, Na, Nd, Os, Pd, Pr, Pt, Rb, Re, Rh, Ru, Sc, Se, Sm, Sr, Tb, Te, Th, Tl, Tm, U, Y, Yb, and Zn are shown on page 4.

The requirements of ISO Guides 31, 34, and 35 were followed for the preparation of this certified reference material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

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BS 200A * Code for method Certified values listed as weight percent

| Analysis | * Al | * As | * B | * C | * Ca | * Co | * Cr | * Cu | * Fe | * Mg |
|------------------|---------------|---------------|---------------|--------------|---------------|---------------|---------------|---------------|--------------|---------------|
| 1 | 4 0.0228 | 12 0.0006 | 4 0.0036 | 1 0.073 | 12 0.00002 | 4 0.0510 | 5 0.0001 | 8 0.0027 | 12 0.061 | 4 0.0112 |
| 2 | 12 0.0240 | 9 0.0011 | 5 0.0040 | 1 0.074 | 12 0.00005 | 12 0.0515 | 12 0.0002 | 4 0.0027 | 4 0.063 | 4 0.0117 |
| 3 | 3 0.0243 | 12 0.0012 | 5 0.0040 | 1 0.074 | 4 0.00007 | 4 0.0521 | 5 0.0002 | 12 0.0030 | 4 0.067 | 4 0.0120 |
| 4 | 4 0.0270 | 9 0.0012 | 4 0.0040 | 1 0.076 | 3 0.0002 | 4 0.0543 | 5 0.0002 | 12 0.0030 | 4 0.068 | 3 0.0120 |
| 5 | 4 0.0272 | 3 0.0014 | 4 0.0041 | 1 0.077 | 4 0.0003 | 3 0.0556 | 4 0.0005 | 3 0.0034 | 4 0.068 | 12 0.0125 |
| 6 | 4 0.0276 | 5 0.0014 | 7 0.0041 | 1 0.077 | 4 0.0003 | 4 0.0559 | 4 0.0005 | 5 0.0036 | 5 0.070 | 4 0.0126 |
| 7 | 4 0.0282 | 5 0.0014 | 5 0.0042 | 1 0.077 | 4 0.0003 | 10 0.0560 | 4 0.0005 | 4 0.0038 | 4 0.071 | 4 0.0126 |
| 8 | 4 0.0283 | 5 0.0014 | 5 0.0042 | 1 0.078 | 4 0.0003 | 4 0.0566 | 5 0.0007 | 4 0.0039 | 4 0.074 | 4 0.0127 |
| 9 | 4 0.0284 | 5 0.0015 | 7 0.0043 | 1 0.078 | 5 0.0005 | 8 0.0569 | 4 0.0008 | 4 0.0040 | 4 0.075 | 4 0.0130 |
| 10 | 4 0.0297 | 5 0.0018 | 4 0.0043 | 1 0.078 | 4 0.0005 | 5 0.0574 | 4 0.0009 | 5 0.0040 | 3 0.075 | 4 0.0130 |
| 11 | 5 0.0300 | 5 0.0022 | 4 0.0044 | 1 0.079 | 4 0.0007 | 4 0.0579 | 4 0.0010 | 4 0.0040 | 3 0.076 | 4 0.0130 |
| 12 | 4 0.0302 | 4 0.0025 | 12 0.0044 | 1 0.079 | | 4 0.0580 | 4 0.0010 | 4 0.0040 | 4 0.076 | 5 0.0130 |
| 13 | 4 0.0310 | | 5 0.0045 | 3 0.080 | | 5 0.0585 | 4 0.0010 | 5 0.0041 | 5 0.076 | 4 0.0134 |
| 14 | 4 0.0311 | | 3 0.0047 | 1 0.080 | | 3 0.0590 | 4 0.0010 | 4 0.0043 | 4 0.078 | 5 0.0135 |
| 15 | 5 0.0314 | | 4 0.0050 | 5 0.080 | | 5 0.0600 | 4 0.0010 | 5 0.0043 | 5 0.078 | 4 0.0140 |
| 16 | 4 0.0320 | | | 1 0.082 | | 8 0.0604 | 3 0.0012 | 4 0.0044 | 10 0.079 | 5 0.0145 |
| 17 | 5 0.0324 | | | 1 0.083 | | 4 0.0610 | | 10 0.0050 | 5 0.080 | 4 0.0156 |
| 18 | | | | | | | | 4 0.0050 | 4 0.081 | 12 0.0160 |
| Average | 0.02812 | 0.00148 | 0.00438 | 0.0782 | 0.000281 | 0.0564 | 0.00062 | 0.00382 | 0.0738 | 0.01307 |
| Std dev | 0.00071 | 0.00010 | 0.00014 | 0.0014 | 0.000082 | 0.0010 | 0.00033 | 0.00019 | 0.0012 | 0.00042 |
| H | 0.00106 | 0.00106 | 0.00044 | 0.0017 | 0.000120 | 0.0015 | 0.00017 | 0.00041 | 0.0017 | 0.00074 |
| U ₁ | 0.00130 | 0.00110 | 0.00046 | 0.0022 | 0.000150 | 0.0018 | 0.00038 | 0.00045 | 0.0021 | 0.00085 |
| t-statistic | 2.12 | 2.20 | 2.14 | 2.12 | 2.23 | 2.12 | 2.13 | 2.11 | 2.11 | 2.11 |
| U ₂ | 0.00065 | 0.00067 | 0.00025 | 0.0011 | 0.00010 | 0.00092 | 0.00020 | 0.00023 | 0.0010 | 0.00042 |
| Certified | 0.0281 | 0.0015 | 0.0044 | 0.078 | 0.0003 | 0.0564 | 0.0006 | 0.0038 | 0.074 | 0.0131 |
| Uncertainty | 0.0007 | 0.0007 | 0.0003 | 0.001 | 0.0001 | 0.0009 | 0.0002 | 0.0002 | 0.001 | 0.0004 |

| Analysis | * Mn | * Mo | * N | * Nb | * Ni | * O | * P | * S | * Si | * Ti |
|------------------|--------------|---------------|---------------|---------------|--------------|---------------|---------------|---------------|---------------|---------------|
| 1 | 12 0.136 | 12 0.00003 | 2 0.0002 | 12 0.000005 | 3 99.53 | 2 0.0011 | 12 0.0001 | 1 0.0021 | 4 0.0005 | 4 0.0367 |
| 2 | 5 0.140 | 12 0.00004 | 2 0.0003 | 12 0.00001 | 5 99.53 | 2 0.0011 | 12 0.0001 | 1 0.0024 | 4 0.0025 | 4 0.0393 |
| 3 | 1 0.144 | 5 0.00005 | 2 0.0004 | 5 0.00001 | 10 99.54 | 2 0.0013 | 7 0.0002 | 1 0.0027 | 4 0.0029 | 5 0.0400 |
| 4 | 12 0.145 | 5 0.0001 | 2 0.0004 | 5 0.00005 | 4 99.54 | 2 0.0016 | 4 0.0002 | 1 0.0029 | 12 0.0033 | 4 0.0400 |
| 5 | 4 0.148 | 4 0.0001 | 2 0.0004 | 5 0.00005 | | 2 0.0016 | 5 0.0003 | 1 0.0032 | 12 0.0040 | 12 0.0400 |
| 6 | 5 0.148 | 4 0.0002 | 2 0.0005 | 5 0.0002 | | | 4 0.0004 | 1 0.0035 | 5 0.0045 | 12 0.0415 |
| 7 | 4 0.150 | 4 0.0002 | 2 0.0005 | 4 0.0003 | | | 4 0.0005 | 3 0.0036 | 3 0.0046 | 4 0.0420 |
| 8 | 4 0.150 | 5 0.0002 | 2 0.0005 | 5 0.0005 | | | 4 0.0005 | 1 0.0036 | 4 0.0050 | 4 0.0420 |
| 9 | 3 0.150 | 4 0.0004 | | 4 0.0005 | | | 4 0.0007 | 12 0.0038 | 4 0.0050 | 3 0.0424 |
| 10 | 4 0.151 | 4 0.0005 | | 4 0.0008 | | | 10 0.0010 | 1 0.0038 | 5 0.0050 | 4 0.0430 |
| 11 | 4 0.151 | 4 0.0005 | | 4 0.0010 | | | 5 0.0010 | 5 0.0040 | 4 0.0060 | 5 0.0431 |
| 12 | 4 0.153 | 4 0.0006 | | 4 0.0010 | | | 4 0.0010 | 1 0.0040 | 4 0.0073 | 4 0.0432 |
| 13 | 5 0.160 | 4 0.0007 | | 4 0.0012 | | | 5 0.0014 | 1 0.0040 | 5 0.0074 | 4 0.0440 |
| 14 | 5 0.160 | 3 0.0007 | | 3 0.0018 | | | 3 0.0017 | 1 0.0040 | 4 0.0080 | 5 0.0445 |
| 15 | 4 0.161 | 4 0.0010 | | | | | 4 0.0019 | 1 0.0043 | 4 0.0080 | 5 0.0455 |
| 16 | 4 0.164 | 4 0.0010 | | | | | | 1 0.0043 | 4 0.0099 | 7 0.0468 |
| 17 | 8 0.165 | 4 0.0010 | | | | | | 1 0.0044 | | 4 0.0485 |
| 18 | 4 0.171 | | | | | | | 1 0.0047 | | 4 0.0503 |
| 19 | | | | | | | | 1 0.0050 | | |
| Average | 0.1506 | 0.00045 | 0.000398 | 0.000433 | 99.535 | 0.00129 | 0.00074 | 0.00370 | 0.00512 | 0.04266 |
| Std dev | 0.0018 | 0.00012 | 0.000068 | 0.000080 | 0.0046 | 0.00032 | 0.00018 | 0.00026 | 0.00026 | 0.00080 |
| H | 0.0023 | 0.00015 | 0.000141 | 0.000147 | 0.0501 | 0.00025 | 0.00019 | 0.00041 | 0.00047 | 0.00129 |
| U ₁ | 0.0029 | 0.00019 | 0.000160 | 0.000170 | 0.0500 | 0.00040 | 0.00026 | 0.00048 | 0.00054 | 0.00150 |
| t-statistic | 2.11 | 2.12 | 2.36 | 2.16 | 3.18 | 2.78 | 2.14 | 2.10 | 2.13 | 2.11 |
| U ₂ | 0.0015 | 0.00010 | 0.00013 | 0.00010 | 0.080 | 0.00050 | 0.00014 | 0.00023 | 0.00029 | 0.00075 |
| Certified | 0.151 | 0.0004 | 0.0004 | 0.0004 | 99.54 | 0.0013 | 0.0007 | 0.0037 | 0.0051 | 0.0427 |
| Uncertainty | 0.002 | 0.0001 | 0.0001 | 0.0001 | 0.08 | 0.0005 | 0.0001 | 0.0002 | 0.0003 | 0.0008 |

BS 200A * Code for method Certified values listed as weight percent

| Analysis | * | V | * | W |
|------------------|----|---------------|----|---------------|
| 1 | 5 | 0.0001 | 12 | 0.000003 |
| 2 | 5 | 0.0001 | 5 | 0.00002 |
| 3 | 12 | 0.0001 | 5 | 0.00004 |
| 4 | 12 | 0.0002 | 4 | 0.00005 |
| 5 | 12 | 0.0002 | 5 | 0.00005 |
| 6 | 4 | 0.0002 | 12 | 0.0002 |
| 7 | 5 | 0.0002 | 4 | 0.0005 |
| 8 | 4 | 0.0004 | 3 | 0.0008 |
| 9 | 4 | 0.0005 | 5 | 0.0009 |
| 10 | 5 | 0.0007 | 4 | 0.0010 |
| 11 | 4 | 0.0009 | 4 | 0.0016 |
| 12 | 4 | 0.0010 | 5 | 0.0020 |
| 13 | 4 | 0.0010 | | |
| 14 | 4 | 0.0011 | | |
| 15 | 4 | 0.0012 | | |
| 16 | 3 | 0.0012 | | |
| Average | | 0.000568 | | 0.000506 |
| Std dev | | 0.000063 | | 0.000068 |
| H | | 0.000167 | | 0.000158 |
| U ₁ | | 0.000180 | | 0.000170 |
| t-statistic | | 2.13 | | 2.20 |
| U ₂ | | 0.00010 | | 0.00011 |
| Certified | | 0.0006 | | 0.0005 |
| Uncertainty | | 0.0001 | | 0.0001 |

BS 200A * Code for method Informational values listed as weight percent

| Analysis | * | Pb | * | Sb | * | Sn | * | Ta | * | Zr |
|----------------|----|-----------|----|-----------|----|----------|----|----------|----|----------|
| 1 | 5 | 0.00003 | 12 | 0.000005 | 5 | 0.000005 | 12 | 0.00002 | 5 | 0.00001 |
| 2 | 4 | 0.00004 | 12 | 0.000006 | 12 | 0.00002 | 5 | 0.00004 | 12 | 0.00002 |
| 3 | 5 | 0.00004 | 5 | 0.000008 | 12 | 0.00002 | 5 | 0.00005 | 3 | 0.0005 |
| 4 | 12 | 0.00004 | 5 | 0.00001 | 5 | 0.00005 | 5 | 0.00005 | 4 | 0.0008 |
| 5 | 5 | 0.00004 | 15 | 0.00001 | 4 | 0.0002 | 5 | 0.0001 | | |
| 6 | 5 | 0.00005 | 5 | 0.00002 | | | 4 | 0.0002 | | |
| 7 | 5 | 0.00005 | 5 | 0.00002 | | | 4 | 0.0005 | | |
| 8 | 12 | 0.00005 | 9 | 0.00002 | | | 3 | 0.0007 | | |
| 9 | 5 | 0.00007 | 5 | 0.00002 | | | 4 | 0.0011 | | |
| 10 | 5 | 0.00007 | 5 | 0.00004 | | | | | | |
| 11 | 4 | 0.00008 | 5 | 0.00005 | | | | | | |
| 12 | 9 | 0.00010 | 5 | 0.00005 | | | | | | |
| Average | | 0.000050 | | 0.0000230 | | 0.000067 | | 0.00031 | | 0.00038 |
| Std dev | | 0.000032 | | 0.0000080 | | 0.000073 | | 0.00019 | | 0.00050 |
| H | | 0.000053 | | 0.000037 | | 0.000061 | | 0.00013 | | 0.00014 |
| U ₁ | | 0.000062 | | 0.000038 | | 0.000095 | | 0.00023 | | 0.00052 |
| t-statistic | | 2.20 | | 2.20 | | 2.78 | | 2.31 | | 3.18 |
| U ₂ | | 0.000039 | | 0.000024 | | 0.00012 | | 0.00018 | | 0.00082 |
| (Certified) | | (0.00005) | | (0.00002) | | (0.0001) | | (0.0003) | | (0.0004) |
| (Uncertainty) | | (0.00004) | | (0.00002) | | (0.0001) | | (0.0002) | | (0.0008) |

For each element, in accordance with the requirements of ISO Guides 34 and 35, an effort must be made to account for the effects on the certified value of the uncertainty estimate from the homogeneity testing and the uncertainties of the contributing laboratories. The average (A) is calculated using a weighted mean where the reciprocal of the square of each laboratory's uncertainty (U_i) is used as the weight (w_i) for its mean (M_i). The standard deviation (S) is calculated as the square root of the reciprocal of the sum of the weights. All but the final reported values are taken to two significant figures as determined by the standard deviation. Thus, $w_i = 1/U_i^2$, $A = \sum w_i M_i / \sum w_i$, and $S = 1/\sqrt{\sum w_i}$. U₁ is the combined uncertainty from homogeneity and labs ($\sqrt{H^2 + S^2}$). The final uncertainty estimate (U₂) is the coverage factor (95 % t-statistic) times U₁ divided by the square root of the number of contributing laboratories ($t \times U_1 / \sqrt{n}$). The final reported Uncertainty is U₂, rounded to one significant figure and the final reported Certified value is A, rounded to the same decimal place as the Uncertainty. For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 section 6.

BS 200A

* Code for analytical method

Trace analysis listed as mg/kg (ppm)

| Analysis | * Ag | * Au | * Ba | * Be | * Bi | * Br | * Cd | * Ce | * Cl | * Cs |
|----------|---------|---------|----------|----------|---------|-----------|---------|-----------|-----------|-----------|
| 1 | 5 0.03 | 12 0.05 | 12 0.005 | 12 0.025 | 5 0.02 | 12 0.0025 | 5 0.1 | 12 0.0025 | 12 0.0005 | 12 0.0025 |
| 2 | 12 0.05 | 5 0.5 | | | 5 0.035 | | 12 0.25 | | | |
| 3 | 5 0.2 | | | | 12 0.04 | | 12 0.25 | | | |
| 4 | 9 0.25 | | | | 5 0.05 | | 5 0.3 | | | |
| 5 | 5 0.5 | | | | 5 0.1 | | 15 0.5 | | | |
| 6 | 5 0.5 | | | | 5 0.1 | | 5 0.5 | | | |
| 7 | 5 0.5 | | | | 5 0.15 | | 5 0.5 | | | |
| 8 | 5 0.5 | | | | 5 0.5 | | | | | |
| 9 | 5 0.9 | | | | 9 1 | | | | | |

| Analysis | * Dy | * Er | * Eu | * F | * Ga | * Gd | * Ge | * Hf | * Hg | * Ho |
|----------|-----------|-----------|-----------|----------|---------|-----------|---------|----------|----------|-----------|
| 1 | 12 0.0025 | 12 0.0025 | 12 0.0025 | 12 0.025 | 5 0.1 | 12 0.0025 | 12 0.05 | 12 0.025 | 12 0.025 | 12 0.0025 |
| 2 | | | | | 12 0.10 | | 5 0.3 | | 5 0.05 | |
| 3 | | | | | 12 0.12 | | | | | |
| 4 | | | | | 5 0.2 | | | | | |
| 5 | | | | | 5 0.2 | | | | | |
| 6 | | | | | 5 0.25 | | | | | |
| 7 | | | | | 5 0.5 | | | | | |
| 8 | | | | | 5 1.1 | | | | | |

| Analysis | * I | * In | * Ir | * K | * La | * Li | * Lu | * Na | * Nd | * Os |
|----------|-----------|---------|----------|---------|-----------|-----------|-----------|----------|-----------|---------|
| 1 | 12 0.0025 | 12 0.05 | 12 0.025 | 12 0.05 | 12 0.0025 | 12 0.0025 | 12 0.0025 | 12 0.063 | 12 0.0025 | 12 0.16 |
| 2 | | 5 0.1 | | | | | | | | |

| Analysis | * Pd | * Pr | * Pt | * Rb | * Re | * Rh | * Ru | * Sc | * Se | * Sm |
|----------|---------|-----------|---------|----------|----------|----------|----------|-----------|---------|-----------|
| 1 | 12 0.05 | 12 0.0025 | 12 0.05 | 12 0.005 | 12 0.025 | 12 0.025 | 12 0.025 | 12 0.0005 | 12 0.05 | 12 0.0025 |
| 2 | | | | | | | | | 12 0.20 | |
| 3 | | | | | | | | | 5 0.3 | |
| 4 | | | | | | | | | 15 0.66 | |
| 5 | | | | | | | | | 5 0.7 | |
| 6 | | | | | | | | | 9 0.8 | |
| 7 | | | | | | | | | 9 1 | |
| 8 | | | | | | | | | 4 1 | |
| 9 | | | | | | | | | 5 1.2 | |
| 10 | | | | | | | | | 9 1.5 | |

| Analysis | * Sr | * Tb | * Te | * Th | * Tl | * Tm | * U | * Y | * Yb | * Zn |
|----------|--------|-----------|---------|-----------|----------|-----------|-----------|----------|-----------|--------|
| 1 | 12 0.5 | 12 0.0025 | 5 0.05 | 12 0.0025 | 12 0.025 | 12 0.0025 | 12 0.0025 | 12 0.025 | 12 0.0025 | 5 1.4 |
| 2 | | | 15 0.05 | | 5 0.025 | | | | | 8 2 |
| 3 | | | 12 0.05 | | 5 0.027 | | | | | 4 3.2 |
| 4 | | | 9 0.1 | | 5 0.04 | | | | | 5 4 |
| 5 | | | 9 0.1 | | 5 0.05 | | | | | 5 4.1 |
| 6 | | | 9 0.25 | | 5 0.3 | | | | | 8 4.3 |
| 7 | | | 5 0.25 | | 9 0.5 | | | | | 12 4.4 |
| 8 | | | 5 0.5 | | 5 0.5 | | | | | 5 5 |
| 9 | | | 5 0.6 | | 5 0.5 | | | | | 5 5.2 |

Analytical Method Codes:

| | | | | | | | |
|---|-------------------------|---|-------------------------|----|----------------------|----|------------------------|
| 1 | Combustion (ASTM E1019) | 5 | ICP Mass Spectrometry | 9 | GF Atomic Absorption | 13 | Titrimetric |
| 2 | Fusion (ASTM E 1019) | 6 | Gravimetric | 10 | X-Ray Fluorescence | 14 | DCP Atomic Emission |
| 3 | Spark Atomic Emission | 7 | Photometric | 11 | GD Atomic Emission | 15 | HG Atomic Fluorescence |
| 4 | ICP Atomic Emission | 8 | Flame Atomic Absorption | 12 | GD Mass Spectrometry | | |

ICP = Inductively Coupled Plasma

GF = Graphite Furnace

GD = Glow Discharge

DCP = Direct Current Plasma

HG = Hydride Generation

Co-operating Laboratories:

| Laboratory | Location | Registrar | Accreditation |
|---|-----------------|--------------------------------------|-----------------|
| ATI Allvac | Monroe, NC | PRI/Nadcap | 17025 |
| Brammer Standard Company, Inc. | Houston, TX | A2LA | 17025, Guide 34 |
| Dirats Laboratories | Westfield, MA | PRI/Nadcap | 17025 |
| Elemental Analysis, Inc. | Lexington, KY | A2LA | 17025 |
| Inco Test | Huntington, WV | PRI/Nadcap | 17025 |
| Instytut Metalurgii Zelaza | Gliwice, Poland | Polish Center For Accreditation | AB 554 |
| Laboratory Testing, Inc. | Hatfield, PA | PRI/Nadcap | 17025 |
| LECO Corporation | St. Joseph, MI | The British Standards Institution | 9001 |
| Ledoux & Company | Teaneck, NJ | EQA (Ireland) | 9001 |
| National Analysis Center For Iron & Steel | Beijing, China | China National Accreditation Service | 17025 |
| Northern Analytical Laboratory, Inc. | Londonderry, NH | PRI/Nadcap | 17025 |
| NSL Analytical | Cleveland, OH | PRI/Nadcap | 17025 |
| Shiva Technologies, Inc. | Syracuse, NY | PRI/Nadcap | 17025 |
| VHG Labs | Manchester, NH | A2LA | Guide 34 |

Certification Process: The requirements of ISO Guides 31, 34, and 35, were followed for the preparation of this reference material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

Analysis: Chemical analyses were made on chips prepared by an end Mill from a representative sample of the certified portion of the lot in accordance with ASTM Standard Practice E 1806. The laboratories participating in the testing followed the requirements of ISO Standard 17025. Methods of analysis used were those listed on page 4.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on pages 2 through 4: SRM 126C, 866, 867, 882, 897, 899, 1243, 1249, 3119A, 3137, 3158; 501-024, 501-149, 501-501, 501-503, 501-506, 501-550, 501-673, 501-991, 501-992, 502-102, 502-257; IMZ 181; NCS HC11520: 24X WASP4 C, ECRM 328-1; IARM 50A, 190A; AR 511; BAS 335, 337, 345, 346, 346A, 351; BS 200, 200-1, 200-2, 200-3, 200-4

Homogeneity: This Certified Reference Material (CRM) was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by spark atomic emission spectrometry and found to be compatible with the following Reference Materials: BS 200, 200-1, 200-2, 200-3, 200-4; 21X 17521J; VAW 4-28

Validity statement: ISO Guide 31 states that the certification should contain an expiration date for all materials where instability has been demonstrated or is considered possible, after which the certified value is no longer guaranteed by the certifying body. The certification of BS 200A is valid indefinitely. The certification is nullified if this CRM is damaged, contaminated, or otherwise modified.

Source: The bar stock for this CRM was produced by Inco Alloys International.

Form: This CRM is machined in the form of a disc, approximately 38 mm in diameter and 12 mm thick by Brammer Standard Company, Inc.

Use: This CRM is intended for use in spark atomic emission and x-ray spectrometric methods of analysis. Refer to ISO Guide 33 for information about the use of Certified Reference Materials.

Certified area: The entire depth of the CRM may be used.

Caution: As with any bar material, avoid spark atomic emission spectrometric burns in the center of the CRM (5 mm radius), as some segregation may be present.

Sample Preparation: For best analytical results, use the same method for preparing the analytical surface on all reference materials as you use for production specimens. Avoid overheating the sample during surface preparation.

Certificate Number: The unique identification number for this certificate of analysis is REV200A-052511. You may obtain information on revisions of certificates from the internet at www.brammerstandard.com.

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. Inquiries concerning this Reference Material should be directed to:

Brammer Standard Co., Inc. Phone: (281) 440-9396 web: www.brammerstandard.com
14603 Benfer Road
Houston, Texas 77069-2895 USA Fax: (281) 440-4432 e-mail: contact@brammerstandard.com

Revision: This certified reference material was originally certified as a reference material on June 06, 1991, before extensive homogeneity studies were employed. A comprehensive homogeneity study, including additional information about its contribution to the uncertainty estimates, was performed. The revision supplies uncertainty estimates for all certified elements. Additional interlaboratory testing was performed. The elements As, Ca, N, and O have been added to the certified list. Ni, Cr and Nb have been changed from informational to certified. Pb has been changed from certified to informational. Refined values for all elements except B are presented. Informational values for Sn, Ta, Zr, and Sb are provided. All informational and trace data are presented in ppm. A number of trace elements have been added.

Brammer Standard Company, Inc., is accredited by the American Association For Laboratory Accreditation (A2LA) to ISO Guide 34 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials (Certificate Number 656.02)

Brammer Standard Company's Chemical Laboratory is accredited by A2LA to ISO Standard 17025. (Certificate Number 656.01)

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001:2008 by National Quality Assurance (NQA), U.S.A.

The scopes of accreditation are listed on the website: www.brammerstandard.com

References:

Versions used were those available at the time of testing and characterization

- E 826 Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectrometry
- E 1019 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques
- E 1806 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

ISO Standard 17025:2005 General requirements for the competence of testing and calibration laboratories

ISO Standard 9001:2008 Quality Management Systems - Requirements

ISO Guide 30:1992 Terms and definitions used in connection with reference materials + 2008 amendment

ISO Guide 31:2000 Reference materials - Contents of certificates and labels

ISO Guide 33:2000 Uses of certified reference materials

ISO Guide 34:2009 General requirements for the competence of reference material producers

ISO Guide 35:2006 Reference Materials - General and statistical principles for certification

ASTM documents available from ASTM, 1916 Race Street, Philadelphia, PA, 19103.

ISO Guides and Standards available from Global Engineering - www.global.ihs.com

Other useful documents available from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.

NIST Special Publication 260-100, Handbook for SRM Users

NIST Special Publication 829, Use of NIST Standard Reference Materials for Decisions on Performance of Analytical Chemical Methods and Laboratories

Certified by: _____ on May 25, 2011.

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